THE MARINE REVIEW

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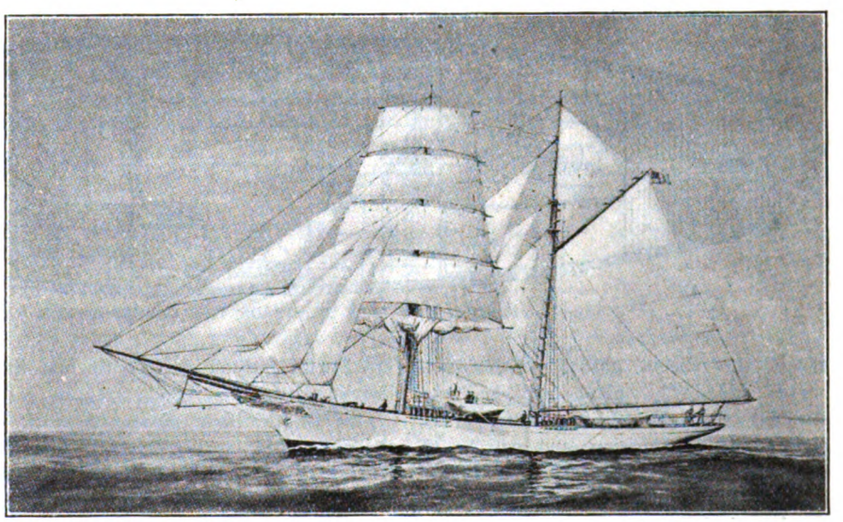
The Non-Magnetic Survey Vessel Carnegie.

The survey vessel Carnegie, now being built at the Tebo Yacht Basin, Brooklyn, N. Y., for the Carnegie Institution of Washington, is unique in that it will be the first vessel constructed, so far as is practicable, of non-magnetic materials. The Carnegie is intended for ocean surveys, and is being built specially for this work from plans and specifications prepared by Henry J. Gislow, naval architect, of New York. The best materials obtainable will be used in the construction of the vessel, which, in addition to the non-magnetic qualities mentioned, will have the strength and seaworthiness of a merchant vessel combined with the finish and accommodation of a yacht.

The general dimensions of the Carnegie are, length over all, 155 ft. 6 in.; length on load water line, 128 ft. 4 in.; beam, molded, 33 ft.; depth of hold, 12 ft. 9 in., with a mean draught of 12 ft. 7 in., and a displacement, with all stores and equipment aboard, of 568 tons. In the construction of the hull, the keel, stem, stern, frames and deadwood will be of white oak, the deck beams, planking and ceiling will be of yellow pine, and the deck of Oregon pine, in long lengths, comb-grained. The fastenings will consist of locus treenails, copper and Tobin bronze bolts and composition spikes, all through bolts being riveted over rings inside and outside. Bronze, copper, and gun metal will be the material used in all metal deck fittings.

In addition to being brigantine rigged, with a capacity of nearly 12,900 sq. ft. of plain sail, the Carnegie will have auxiliary propelling machinery capable of giving her a speed of six knots. This auxiliary power plant consists of a six-cylinder internal combustion engine, having a capacity of 125 I. H. P. when making 350 R. P. M. With the exception of the thin cast iron cylinder liners and the steel valve cams, the engine will be constructed of manganese and other bronzes. The shaft will be of Tobin bronze and the propeller, of special feathering-type design, of manganese bronze. The gas will be generated in a producer gas plant having a capacity of 130 lbs. of anthracite pea coal per hour and producing a steady, pure gas containing 80 per cent of the heat units possessed by coal. A coal bunker capacity of 25 tons will give the Carnegie a cruising radius of 2,000 miles, but the engine will be used only in maneuvering the vessel in crowded waters or during a calm at sea.

As will be seen in the illustrations, the quarters of the navigating and scientific staff are located amidships. The officers' mess room is shown forwarded of the ward room, the staterooms of the captain, mate and machinist opening into it, as does also their bathroom and toilet. The quarters of the scientific staff extend the full width of the vessel for a length of 38 ft. 6 in., and consist of a ward room, five staterooms, a library and the commander's office. The wardroom is 25 ft. in length by 11 ft. 6 in. in width, and has three staterooms and the commander's office arranged on the port side and two staterooms and the library on the starboard side. Ventilation and light are obtained by means of a cabin trunk on the main deck, this trunk being 42 ft. 8 in. in length, 16 ft. 6 in. in width by 3 ft. in height, and heavily constructed of bright-finished teak wood. The fore castle has



CARNEGIE, NON-MAGNETIC YACHT, AS SHE WILL APPEAR WHEN COMPLETED.

accommodations for 8 men and is located abaft of the forward collision bulkhead. It is 19 ft. 6 in. in length and extends the width of the vessel. The crew's galley is situated aft of the forecastle, and is 8 ft. in length by 16 ft. in width, the cook and mess room steward occupying a double stateroom on the port side, abreast of the galley.

The observation room, 14 ft. 6 in. in length and 16 ft. in width, is located on top of the cabin trunk. A circular observatory is on each end of the trunk, these observatories being 7 ft. 6 in. in diameter and fitted each with a revolving dome constructed of bronze frame work and plate glass. A chronometer cabinet and instrument case are fitted, in the forward end of the ward room.

An ice-making and refrigerating plant of the ethyl chloride type is situated aft of the officers' galley, on the starboard side. The plant will be constructed throughout of bronze, brass, copper and composition, and will be of sufficient capacity to insure a liberal ice supply and ample refrigeration. The supply of fresh water will be carried in wooden tanks fitted under the cabin and forecastle floors, these tanks having capacity of not less than 6,000 gallons and being connected and fitted with piping to all parts of the vessel. The balance of the space under the cabin floor will be arranged in bins and compartments for the storage of various supplies as may be required.

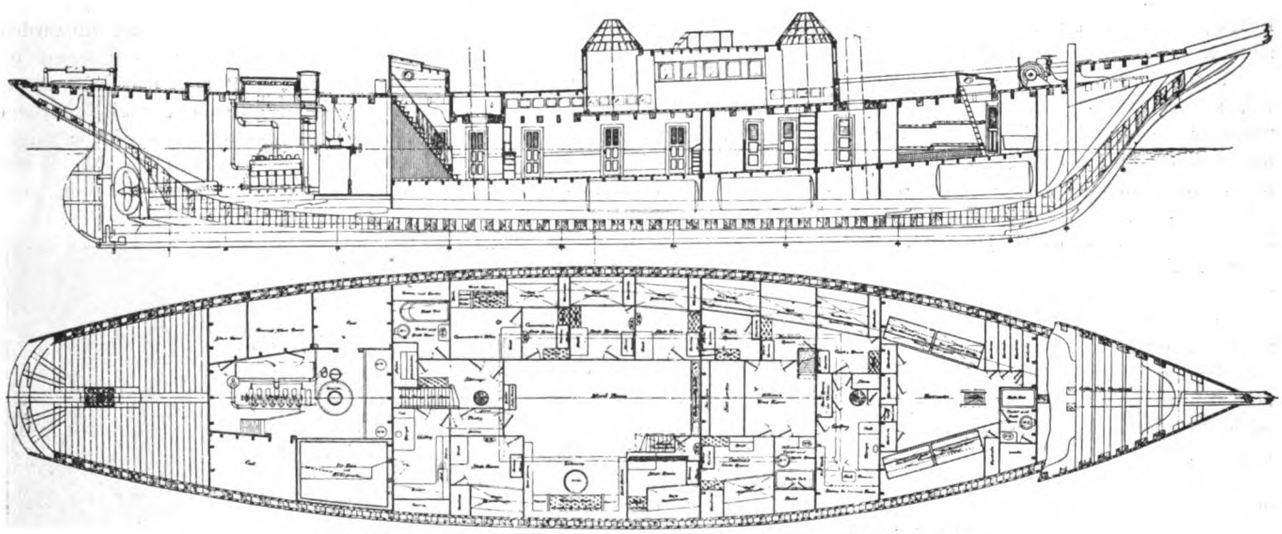
Teak wood will be used in the construction of skylights, companionway, hoods and other wooden deck fittings, mahogany being principally used for the interior fittings. The doors and bulkheads dividing the various rooms will be of white pine finished in white enamel paint. The staterooms, messroom, wardroom, bath rooms, etc., are elaborately fitted throughout, the crew's quarters also having unusual conveniences.

On account of the Carnegie being required to be practically non-magnetic many difficulties were encountered in preparing the plans and specifications. These, however, have been overcome, and, with the exception of the cast iron cylinder liners and steel cams aforementioned, which aggregate less than 600 pounds, there will be no magnetic material used in the construction of the vessel. Needless to add, this applies to all plumbing and fittings. Six transverse bulkheads divide the hull into seven watertight compartments, so that, with even two compartments stove in, the Carnegie will still float. Further safety is secured by having all hatches fitted with locking devices for use in a heavy seaway.

One of the first pieces of work of the magnetic survey vessel Carnegie will be to plot the compass variations in Hudson Bay and in the North Atlantic Ocean. The Canadians, who are opening up the great lands of western Canada, are going to run a line of steamers through Hudson Bay from Churchill to Liverpool. This will give them open water through the shipping months. As very little information of the compass variations in these waters has been obtained recently the survey will be of great service. According to contract the builders of the Carnegie will have the vessel completed on or before the first day of July, when, after a satisfactory trial trip, she will be placed immediately in commission. She is expected to return to New York about the end of the present year and take up work in the Atlantic Ocean early next year along the traversed routes.

Something over four years ago the Carnegie Institution of Washington undertook the task of making a systematic series of surveys to determine the magnetic conditions all over the deep water seas. A department of research in terrestrial magnetism was organized and the entire work placed under the directorship of Dr. L. A. Bauer, formerly in charge of the magnetic survey of the United States, under the Coast and Geodetic Survey. A survey was first made of the Pacific ocean, where little had been done, with the exception of shore observations on some of the islands and along the coasts, since the voyages of Challenger and of Gazelle (a German expedition) more than 30 years ago. Observations were made from the converted wooden yacht Galilee, which between Aug. 1, 1905, and May, 31, 1908, made three successive voyages in the Pacific, tracing the great circle route, and surveying all spots left uncovered by the Challenger. The total length of these cruises amounted to over 60,000 miles.

The Carnegie will be commanded by W. J. Peters, who also commanded the Galilee during the period 1906-1908. The most northerly point visited by the little survey vessel was Sitka, Alaska, and the most southerly one, Lyttleton, New Zealand.



PROFILE AND DECK PLANS OF THE CARNEGIE, NON-MAGNETIC YACHT.

Art. Fische, 11 North East street, Indianapolis, Ind., is desirous of obtaining information concerning the whereabouts of his father, Arthur J. Fish, marine engineer, about 70 years old.

Gas Power Aboard Ship.

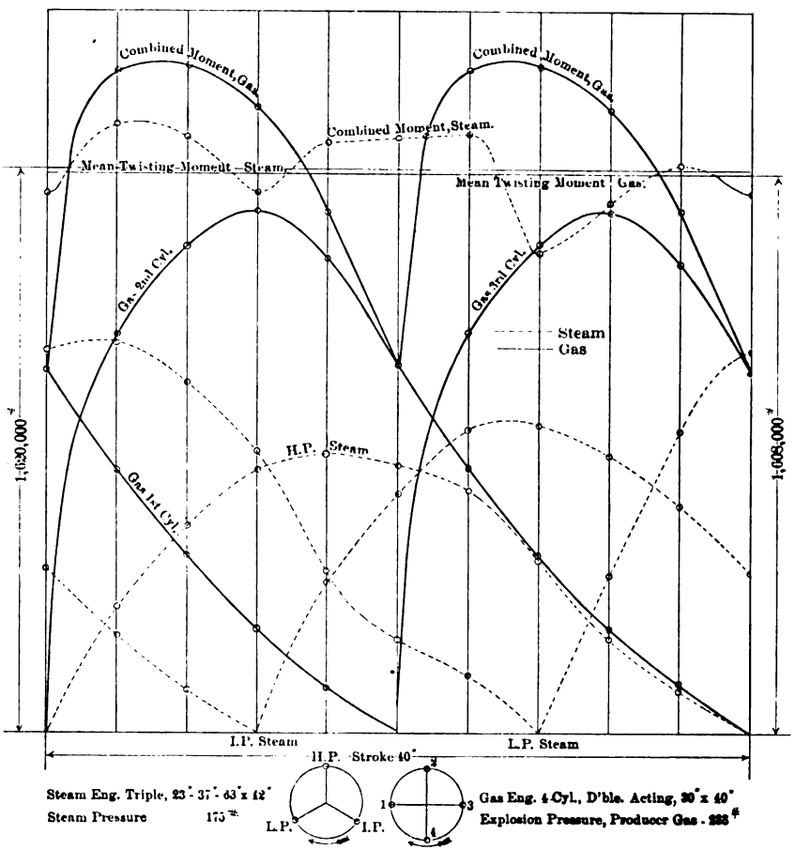
BY HENRY PENTON.

The progress of the internal combustion marine engine as applied to commercial and naval uses is beset with enough real difficulties without the citation of imaginary ones by those who ought to be its friends and supporters, and whom the general public and even a large number of the marine and general engineering fraternity would naturally assume to speak with authority. The problems involved are being conscientiously attacked and considered in all the phases which present knowledge can suggest and one by one either solved or reduced to terms of relative simplicity for which the solution and formulae must needs await actual trial.

The paper on "Gas vs. Steam for Marine Motive Power," by Capt. A. B. Willits, U. S. navy, in the December proceedings of the U. S. naval institute, does not contribute any help to either the question itself or to engineering knowledge in general, and, if read in parallel with the paper by the same author on "Explosive Mixture Motors" in the November, 1906, Journal of the Society of Naval Engineers, can only result in leaving the reader hopelessly lost in amazement at the facility with which the author shifts his ground and wonder at why the established facts of 1906 are become matters of doubt and experiment two years later. A wise man may change his mind in the light of additional knowledge, but the paper in question contains nothing to show that such is at hand. It does, however, contain a number of statements which are put forward as flat-footed facts, and with some of these we take issue. Obviously we cannot quote either paper at length, nor can we take up and discuss them in detail, but must be content with noting the leading points.

The author compares the weights of a 600-brake horsepower single cylinder, single acting, horizontal engine, designed for blast furnace gas, with those of a 10,000-brake horsepower turbine torpedo destroyer. It is difficult to admit the exercise of impartial engineering judgment in such a comparison. It would be even fairer to compare the weights of the simple condensing engine of the early steamships with the turbine than to contrast those of this gas engine with approved and successful double-acting practice, even in stationary work, where the design is influenced, if not controlled, by factors wholly absent in marine work. The point is not apparent, especially in view of the statement in the same paper that a 500-brake horsepower vertical, double acting, marine engine can be built on a weight basis of 30 pounds per brake horsepower, as compared with 465 pounds in the gas engine cited. Moreover, the builders of the same marine engine just referred to, state that they are prepared to build a vertical, double acting marine engine to develop 1,000 brake horsepower at 90 revolutions per minute, with producer gas, on a weight basis of less than 75 pounds per brake horsepower including all engine room weights. Even if this figure were substantially increased it would still be well within the figures of commercial steam practice. Before leaving this question of engine weights we wish to add that if any turbine ship has been built or is building with 10,000 brake horsepower and the total engine room weights of 250,000 pounds, or 25 pounds per brake horsepower, the fact is not generally known and we have failed to obtain any such figures from turbine builders.

The statement is made unequivocally that there have been no engines built as large as 1,000 brake horsepower for producer gas. This statement is not founded on fact. The most casual inquiry among builders of large gas engines would have elicited information of scores of installations running into the thousands in brake horsepower. This is on all-fours with the statements made later on that the down-draft producer using bituminous coal is not in successful use up to the present time, and



COMPARATIVE TWISTING MOMENTS, STEAM & GAS ENGINES, 2000 I.H.P.

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also that it is not satisfactory for engine use. The answers to these may be very brief and categorical. There is more down-draft producer capacity working on bituminous coal than of all other types combined, and of the total engine power in the United States derived from artificial gas (that is, other than natural or blast furnace gas), in units of over 300 brake horsepower, 65 per cent are working on gas from bituminous producers.

The paper also, somewhat arbitrarily, assumes that, for reasons not apparent, the size of gas engine cylinders cannot exceed 20 in. x 24 in., and that larger powers must be obtained by using multiples of this size, and conjures up a vision of a 5,000-horsepower installation consisting of 50 cylinders 20 in. x 24 in., single acting, making a line of 150 ft. in length. The only indication of why this size and type is assumed to represent the limit of advance is that the experimental engine of the Rattler is so designed. Two years ago the same author said "there will be no future for the single acting motor for large powers in marine work."

On the erecting floor in almost any of our large engine-building establishments can be seen gas engines designed for producer gas with double acting cylinders up to 36 in. x 42 in., and even larger, while the trade and technical publications are full of descriptions and illustrations of working plants which refute the statements referred to. Two examples of this, lying immediately at hand as this is written, are found in *Power* for Dec. 8 and 22, 1908; descriptions of actually existing plants, and the most cursory review of the literature on the subject will bring to light numbers of others. Certainly Capt. Willits will not wish to go on record to the effect that a cylinder which will work satisfactorily in a horizontal position will not do at least equally well in a vertical.

The stationary gas engine labors under conditions that do not exist in marine work. Practically in all cases they run under governor control, and, except possibly in the case of blowing engines, must maintain uniform speeds under widely varying loads. These conditions with the extreme variation in angular strains, require not only an abnormally heavy fly-wheel, but that the crankshaft, frames, etc., shall also be extremely heavy, while automatic control entails all the additional complication of governors and adjustable valve gear with the multiplication of parts attendant thereon. These conditions do not exist afloat. The marine engine, in good weather, has the ideal load; governor control and great inertia are not required, and the same conditions that necessitate multiple cranks (handling and maneuvering), contribute to uniform turning effort. For equal powers and revolutions, with a four-cylinder, four-crank, double-acting gas engine, the crankshaft strains are almost identical with those of a three-crank triple expansion steam engine. Neither is there any such disproportion in number of cylinders or space occupied as compared with steam as the paper would have us believe. For instance, the diagram herewith exhibits the crankshaft strains of a triple engine and a gas engine of equal powers, and also the cylinder sizes. Both engines occupy about the same fore-and-aft space; the difference is in favor of the gas engine. Possibly in much higher powers the number of cylinders necessary might become an objection, but on the other hand, where propeller speed does not fix the revolutions, as in most merchant ships, the revolutions and piston speed may be increased beyond those possible with steam, where the difficulty lies not in the piston speed *per se*, but in getting the steam to and from the cylinders, the very same difficulty that gives the turbine its opportunity.

Coming now to the question of space and weight for producers: This article is not written to advertise any particular design nor to criticize those mentioned by Capt. Willits, but we must express surprise at the exclusion or oversight of widely known and successfully operated types delivering gas for engine work from bituminous coal. First as to space: 1,000-brake horsepower capacity in two units, based on 80 per cent efficiency with 13,500 B. T. U. coal, with all necessary apparatus, finds ample stowage in a floor space of 15 x 30 ft., or 0.45 sq. ft. per brake horsepower; a 2,000 B. HP. in three units, in a space 18 x 35 ft., or 0.31 sq. ft. per brake horsepower, compared with the 1.8 sq. ft. as quoted. This takes no account of the reduction in bunker space which the producer makes possible. The weight of both plants, complete with all pipes and connections, scrubbers, etc., up to the manifold on engine, is about 85 pounds per brake horsepower. These are not estimates of imaginery or experimental plants; they are based on actual every-day performance of producers making gas from bituminous coal for engine work, and are a long way from the 285 pounds per brake horsepower quoted and compared with 110 pounds for boiler room weights of a battleship. Possibly the figure quoted for the battleship is correct, but after all naval work is a relatively small and unimportant part of the whole, and if the development of the producer and gas engine wait for the navy none of those now interested in the subject will live to learn much about it. The question will be threshed out in the merchant service where boiler room weights approximate 170 pounds per brake horsepower with water in the boilers.

Altogether the gas power question is in vastly better shape than Capt. Willits seems to be aware, but the fact that it is so is not due to any support the bureau of steam engineering has given it. The fact that the new magnetic survey ship for the Carnegie Institution is to be fitted with a producer and gas engine will go farther to offset the gloomy views of the pessimists than all the pages that could be written. It is to be hoped that the conclusion "in the light of present experience with turbine machinery we would be loth to turn again to reciprocating engines without more than a promising outlook and this we are wholly unable to perceive, as yet, in the marine gas engine" is not the key to the disinclination to look in the direction where accurate information is to be had. There would seem to be rather sudden enthusiasm for the turbine, seeing that the first turbine ships in the U. S. navy are hardly more than out of the builders' hands, and the "light of recent experience", after the first general overhaul at a navy yard, may be as widely dissimilar as Capt. Willits' two papers on marine gas power.

It is not to be expected that perfection will be reached at one bound and with the first installation; rather it will serve to point the way to satisfactory operation, but only thereby can satisfaction come. Even the turbine, for the rapid adoption and growth of which mechanical history furnishes no parallel, did not escape its share of difficulties and failures. The writer has seen within a few days the dismantling and scrapping of several very large power station turbines which have been running successfully and steadily for five or six years simply because they are already out of date. Yet the marine producer and gas engine are fur-

ther advanced today than most proposed radical improvements because the ground has been cleared of the real obstructions by experiment and development in stationary work.

There are no real difficulties in the way, though doubtless many modifications in detail, and it only awaits initiative, which with an opportunity of cutting fuel consumption in half and at the same time increasing earning capacity, will not be long delayed.

THE GAS ENGINE AND PRODUCER PLANT.*

BY E. SHACKLETON.

The question of the gas engine and producer plant, and its application to marine propulsion, is one that has received a large amount of attention and interest from internal combustion engineers, marine engine builders and shipbuilders, some of the latter who, notwithstanding the fact that the gas engine and the gas plant is the prime mover in their own works, seem to be exceedingly chary of giving a trial to the gas engine in the boats they build or engine. It is natural that, after their intimate acquaintance with the steam engine and its traditions, which in many cases dates from over half a century back, they should be very reluctant to adopt a new type of prime mover, which but a few years ago was regarded as only suitable for operating light printing machinery, where power was required not exceeding 10 horsepower. The greatest of poets, Shakespeare, may perchance voice their sentiments where he says, "'Tis better to bear present ills than face others we know not of." The natural opposition of the steam engine builder to anything in the nature of a gas engine was up to a few years ago, very acute, and today, in many cases, is still existent. Still, the economic laws must eventually prevail, and, by reason of severe competition, shipowners will be driven, in the near future, to ask from the builders a cheaper running type of boat as far as fuel consumption is concerned, particularly in the matter of the cargo type, 4,000 to 5,000 tons gross. The present steam type of engine employed is no doubt very economical as far as steam goes, with a consumption, under very favorable circumstances, of slightly over 1 pound per indicated horsepower per hour. The more common range of consumption, however, is in the locality of 1¼ to 2 pounds per indicated horsepower per hour. Even if "superheat" were employed, with the attendant wear and tear, it is questionable whether a consumption of 1 pound per indicated horsepower per hour could be maintained. The chief objections to a gas engine and plant from the marine engineer's point of view, are—

Their inability to reverse. Unreliability, pre-ignitions and back-fires, difficulty in starting, accumulations of dirt and carbon in cylinders and pistons, poisonous gas from leakage of gas plant.

To these objections we would say in regard to:

Reversing difficulty.—This will be dealt with in detail later on.

Unreliability.—There are gas engines at work, and which have been at work for the past six years, with periods of from 3 to 6 months, night and day without stopping.

Pre-ignitions and back-fires.—In well designed gas engines, such as those referred to in this paper, under all normal conditions these troubles are very rare.

Starting.—The use of compressed air for this purpose has now made the starting as easy as that of the steam engine.

Accumulations of dirt and carbon, as a rule, may be traced to an inferior lubricant, or to excessive lubrication, an item that by a little intelligence on the part of the engineer in charge may soon be rectified. If not from this source, the plant, particularly the scrubbers, requires probably looking at, as, under the usual working conditions, a fairly clean gas is delivered to the engines.

Leakage of Poisonous Gases.—Accidents which have occurred under this heading are largely due to the neglect of common precaution, and are extremely rare. The danger arising from the escape of poisonous gas (carbonic oxide) is more likely to occur in starting producer plants which work under pressure, and even during the running of such systems should there be any leakage in the plant. In the case of suction plants, which are operated by suction from the engine, the period of danger from the escape of poisonous gases is limited to the 10 or 15 minutes during which the generator is raised to the necessary temperature by the fan. On shipboard a simple system of ventilating fans would reduce any risk to a minimum.

Wear and Tear and Upkeep.—This is certainly an important item, but as far as the most up-to-date experience is concerned, the labor and cost have been found to be practically little, if any, more than with steam.

The gas engine and plant appear to be more directly suited to marine requirements than the large oil engine, notwithstanding the extra inducement which the latter offers as being self-contained. It is, however, very questionable at the present moment whether the problem of dealing with every description of crude oil, as a fuel in an oil engine has been definitely solved, and even in such event, it is very doubtful if there is any real advantage over the producer plant in power cost. It must also be borne in mind that the most suitable type of engine for operation with crude oil is somewhat complicated and expensive to build. In the scheme proposed, the writer would like to emphasize the fact that he has an individual axe to grind for any particular type of plant, engine, dynamo, or other accessory, and that while he has of necessity selected certain types as particularly suited for the scheme of marine propulsion brought before you, no reflection is intended by non-reference to other plants, engines, etc., of high merit. Specialization is extremely necessary to the ultimate success of the gas boat, and only by such blending of a combination of shipbuilders, marine engine builders, gas engine and plant makers, and electrical engineers, each bringing their varied experience to bear in construction of the boat and her engines, could the desired results be obtained.

After going at length into the details of the forms of gas engines on the market the writer went on to state that a well designed steamer fitted with gas could show a profit of £1,000 over and above the steamer per voyage, irrespective of less labor costs, coaling time saved, cargo discharging fuel economy. Over and above this profit it is probably that from £200 to £250 would be saved in minor charges, which could be written off against the extra cost of construction of the boat.

In conclusion it may be said that the moderate power gas boat must take its place in the marine world at an early date, and the object of this paper is to attract the attention of owners and engineers to the subject with a view to elicit information and provoke discussion.

Much misgiving seems to possess the mind of the average marine engineer regarding the reliability of the gas engine, which they regard as a delicate machine, and not to be com-

*From a paper read before the British Engineering Society.

pared to the beloved steam engine. A well constructed gas engine intelligently looked after, will do periods of running that would not be credited unless actually seen by a marine engineer.

It is but natural that engineers who have had experience of the good work done by the steam engine, and look with suspicion upon a system which has only been fully tried on land, but the entry of the gas engine is inevitable, and it is only fair to ask marine engineers not to anticipate difficulties before they arise. If science or progress did not demand a trial of this form of motor, there is the economic force represented by the shipowner who, in an age of competition with low freights and badly paying ships, is compelled to look for a cheaper type of prime mover in his steamers. This he can have in the gas-engined boat, or the auxiliary sailing vessel. Apparently it is not so much a question of building as inducing owners to leave the beaten track and pay a fair price for such a vessel, but it is to be hoped that a good trial will soon be made to demonstrate all the advantages claimed for the gas engines; our German competitors have already commenced construction of three such boats.

The Mosher Water-Tube Boilers.

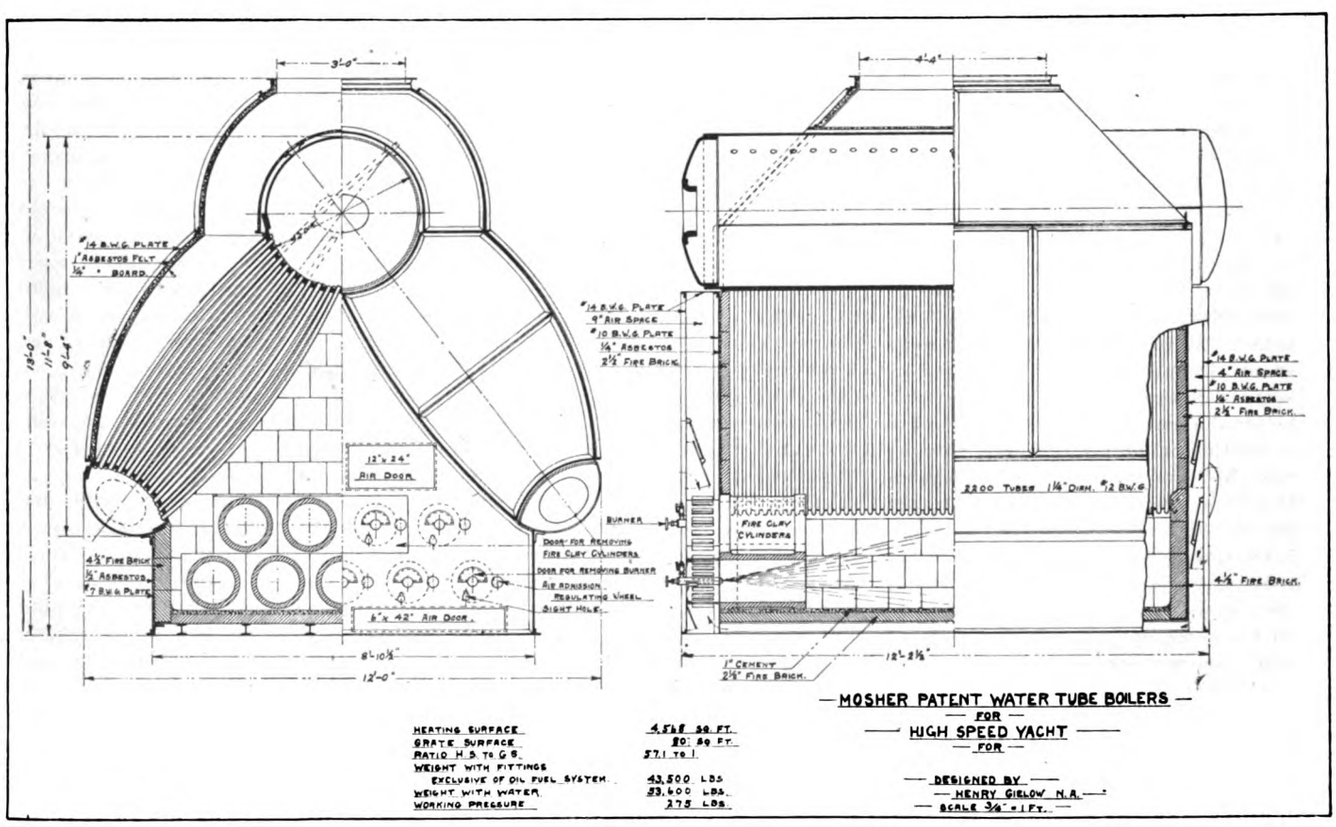
There are few firms engaged in the manufacture of water-tube boilers with a more enviable record than that of the Mosher Water-Tube Boiler Co., of New York. The several types of boilers built by this company have demonstrated their adaptability to all kinds of marine service and the various methods of firing. The applicability of the Mosher boilers may be seen and the advantages of the design appreciated by referring to the accompanying illustrations.

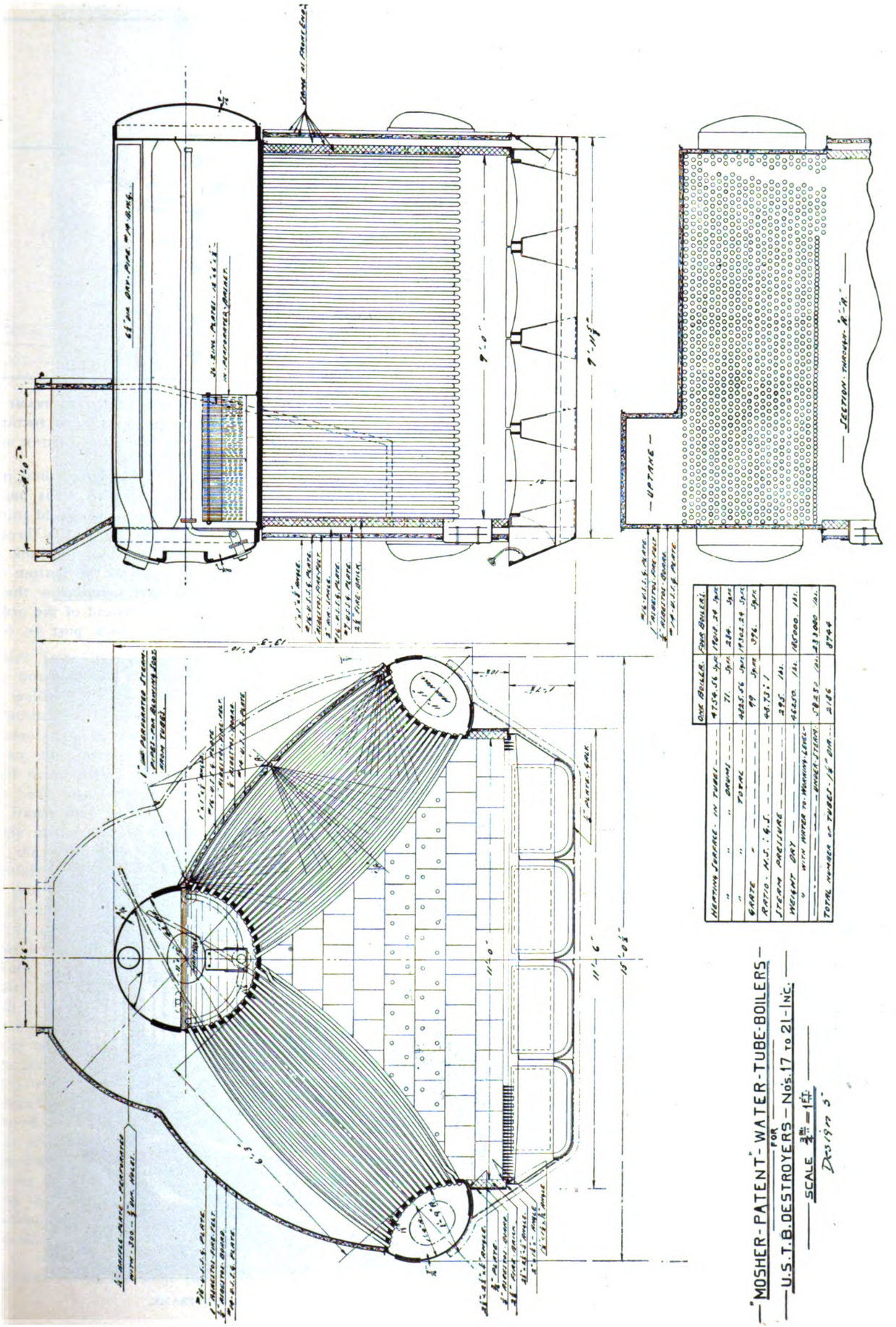
The general arrangement of this type of boiler is best shown in the drawing of the Mosher boiler designed for torpedo boats, torpedo-boat destroyers and scout cruisers, in which a high forced draft is used. All the tubes are slightly curved, so that they aim towards a row of hand-holes in the upper portion of the steam drum, through which as many as 50 tubes may be withdrawn and replaced when necessary by removing a single hand-hole cover in the upper portion of the steam drum. In the longitudinal arrangement the tubes next to the furnace are spaced their own diameter apart, each tube in the first row being bent between the two adjoining tubes of the next row, thus providing a tubular wall, which extends from the fire-door end for three-quarters of the length of the furnace. For the remaining fourth of the length of the furnace the tubes are not bent between the adjoining tubes of the next row, thereby leaving an opening for the passage of the gases of combustion from the furnace among the tubes into the stack at the opposite end of the boiler.

The sides and ends of the furnace are lined with fire brick, which is secured to a steel casing. At the ends of the furnace is a second steel casing, forming an air space connecting with the ash pan. The firebrick is provided with small circular openings, permitting the heated air to pass from the ash pan through the air space into the furnace above the fuel.

Perforated pipes extend the entire length of the boiler, and are provided with a number of rows of holes opposite the space between the tubes to permit jets of steam to be blown among them. Thus, any soot which may have accumulated on the tubes may be blown off simply by opening a steam valve connecting these pipes with the boiler.

The feed water is delivered through





a connection on the lower part of the front head of the steam drum, this connection being provided with internal feed-distributing pipes extending the whole length of the boiler opposite the two outer rows of tubes. These pipes are provided with openings opposite each of these tubes, causing the jets of feed water to be projected down through the outer tubes, and, as these feed pipes are below the water level of the boiler, they act as siphons, causing large volumes of water to be drawn through these tubes, forming an economizer or feed water heater of the two outer rows of tubes. This arrangement also forms a system of forced circulation, thus causing the boiler to be thoroughly reliable even when forced to a rate of evaporation of more than 18 pounds of water per square foot of heating surface.

In the other types shown is a Mosher boiler arranged for burning oil fuel, under the Shutte & Koerting system, as adopted by the British admiralty. This includes the use of fire-clay cylinders in connection with the oil burners and proper dampers for the control of the air supply. The boiler adapted for large vessels, such as battleships. colliers, transports, etc., is provided with a superheater, so arranged that it may be flooded and made a part of the boiler, under which conditions saturated steam will be furnished. To furnish superheated steam it is necessary to close the small valve above referred to and close the large steam valve when the steam generated by the boiler will pass from the dry pipe up into the lower pipe, thence down into the upper drum of the superheater, which is fitted with a diaphragm plate, causing steam to pass down through two inner rows of tubes into the lower drum of the superheater, then up through the two outer rows of tubes into the upper pipe, from where it passes into the main steam connection.

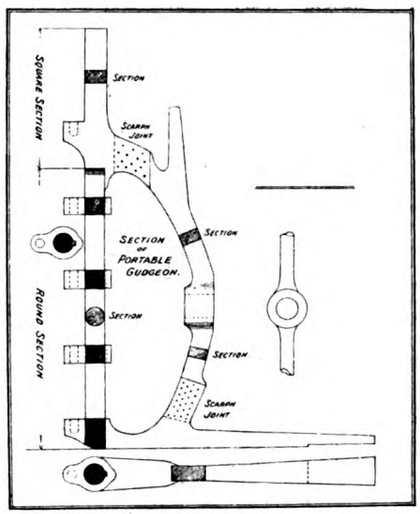
An arrangement of fire tiles baffles causes the gases of combustion to pass in contact with all the boiler tubes before they reach the superheater on the way to the stack.

In order still further to facilitate the renewal of tubes without disturbing any other part of the boiler, the proportions of the parts are so arranged that no removal of any part of the casing is necessary for the removal of the tube. As will be seen by an examination of the illustrations, the operation of the removal of a tube is effected by taking off the hand-hole cover and passing the tube up as far as necessary into the space between the steam drum and the casing, this bringing the lower end of the tube entirely within the steam drum and free of the tube sheet, after which the tube may be passed down and forward into the steam drum and taken out through the front manhole. This operation is clearly shown both in the front and side views of the Mosher boiler, the front view showing how the tube clears the tube sheet of the steam drum when the upper portion is drawn up into the casing, while the side view shows also how the tube is brought into the drum for removal through the manhole.

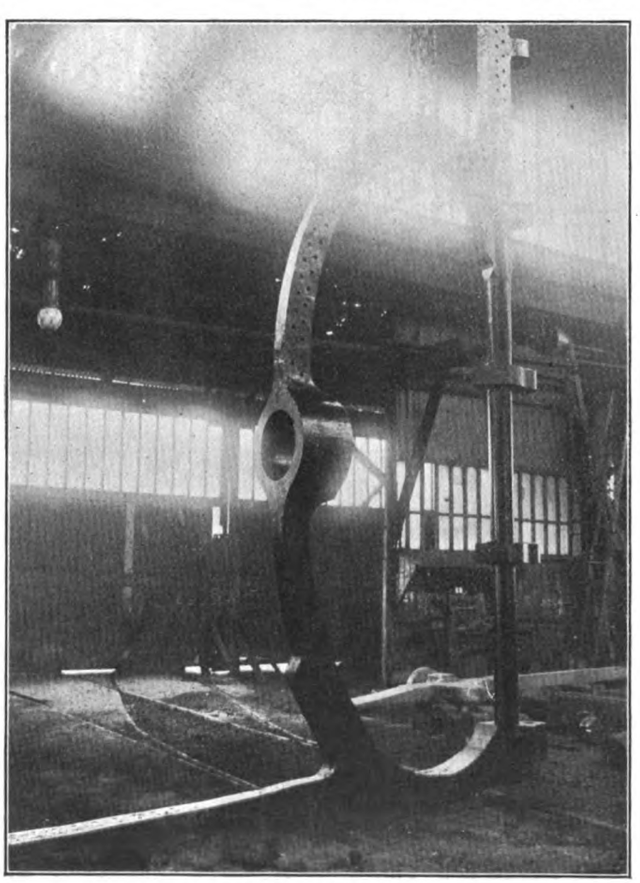
The Mosher Water-Tube Boiler Co. offices are at 30 Church street, New York city.

A NEW TYPE OF STERN FRAME.

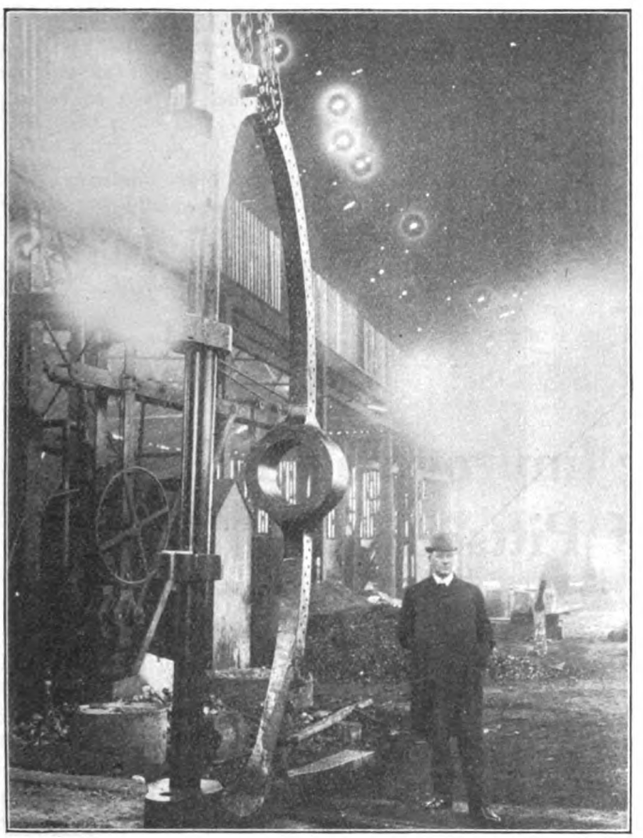
A new type of stern frame has just recently been built from the designs of Arthur A. Fownes, the managing director of the Fownes Forge & Engineering Co., Ltd., of South Shields, England, to whom we are indebted for photographs and drawings from which our illustrations are reproduced. The peculiarity of the design lies in the fact that the stern frame is built together, and is without a weld throughout. The frame is forged in three separate pieces, namely, the back post, the boss piece, and the bottom piece. There is a scarf joint below the boss at the archway instead of the ordinary weld, while the back post is turned



FOWNES' PATENT BUILT STERN FRAME WITH CIRCULAR BACK POST AND PORTABLE GUDGEONS KEYED AND SHRUNK ON.



FOWNES' DESIGN OF STERN FRAME.



FOWNES' DESIGN OF STERN FRAME.

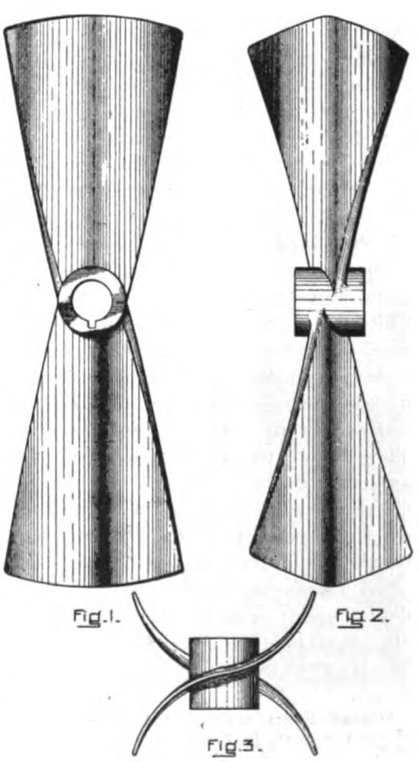
circular from immediately below the arch down to the base. Instead of any welding, the post is shrunk into the bottom keel piece. The gudgeons are also portable, and they are shrunk on to the circular back post and keyed in addition. These innovations have been introduced so that the entire frame may be the more expeditiously manufactured. Under this system the various parts in course of manufacture may be distributed over the several machines, and continuity of machine work is thereby maintained until such time as the various pieces are ready for finally fitting together. It is also claimed that rapid repairs are greatly facilitated, inasmuch as a new bottom piece or back post may be provided without the necessity of having to cut out the entire stern frame from the vessel, and similarly, as the portable gudgeons of damaged vessels can be conveniently replaced without the back post having to be condemned, as is the case with stern frames of other design. In the Fownes design there has been introduced the method of shrinkage in substitution for the older method of welding, which is slower, as only one set of men can be working on any particular job at the same time. This design of stern frame, it is stated, has received the approval of all the various classification societies.

SPEAR PROPELLER DESIGN.

In studying the subject of wave motion as occurs in any fluid medium such as water or an allied substance, the air, the inventor of the propeller shown in the accompanying illustrations noted the fact when waves are set in motion or currents formed they have been produced the most quickly and with the least loss of power where the opposing or actuating surface which causes this motion is curved with the conchoidal curve. As a curved surface of this description can from its nature present no focus or center for converging air waves or liquid waves, as of water, but distributes such waves or currents without so doing, *i. e.*, focusing them, it has seemed best suited to the inventor's purpose in the construction of his propeller blades. Its utility may be readily shown by forming an ear trumpet in such manner that the passage through it shall be of this conchoidal shape, that is, substantially the shape of the passages from the exterior to the interior of a conch shell, and comparing its efficiency with the efficiency of any of the ear trumpets of ordinary construction.

The reason for this, as the inventor believes, is that there is practically no chance for interference between the various waves which are received at the embouchure, or bell mouth entrance, of such ear trumpet, and are conveyed along therefrom to the small opening made for application to the external canal of the ear. In such cases aerial vibrations within the ear trumpet may be considered as conveyed towards the smaller end without meeting with or obstructing the passage of similar vibrations taking the same course. The invention is based upon the application of this same discovery to the construction of propellers, and consists in a propeler provided with two or more blades, one or both surfaces of which blades are conchoidal

Fig. 1 is an end elevation of a propeller embodying the invention; Fig. 2 being a side elevation thereof, and Fig. 3 a top view. The blades are preferably made with a double curve, one-half of the blade projecting forward and the other half rearward in order that the blade may be equally efficient whether it is working foward or backward. In any case the peculiarity of the blade is such that its working surface being conchoidal in shape the particles impinging upon it are forced from its surface practically in one given direction, that is, in a constantly increasing and diverging direction from each other without interference, and hence with but slight resistance other than that due to friction against the blades.



In operation the leading edge and advancing surface of each blade when rotating enters new water to advance the propeller and ship to which it is attached, but because of the absence of this foci and of eddies usually produced by other curved surfaces having foci there is no interference or tendency on the part of one wave (of water) to interfere with another wave. Hence the resistance in front of the blade is reduced to a comparatively small amount while the pressure behind the propeller is not materially reduced.

The blades are preferably so located about the hub that their bases will be at an angle of between 20° and 30° with its axis. As each blade spreads itself preferably from the hub to its extremity the leading edge or entering corners of the blade is in a plane nearly parallel with the axis of rotation so that it cuts the new water with practically no resistance. This result is, in the opinion of the inventor, due to the peculiar property which the convex surface, in this case also conchoidal, has of behaving in the same manner as the concave, and conchoidal surface, as regards interference.

The inventor, Edmund D. Spear, of Boston, Mass., believes the propeller would be equally efficient in air, and though aware that propellers have been constructed, the blades of which have cross sections representing reversed or inflected curves, does not claim a propeller having blades with merely that construction.

The Progress of River Improvements in the Vicinity of Pittsburg.

BY J. W. ARRAS.*

By the final completion of a number of works long under construction, the artificial navigation of rivers at Pittsburg has been extended farther during the past year than in any previous season in the history of their improvement in this locality. The Pittsburg Engineer district, at present in charge of Major H. C. Newcomer, corps of engineers, United States army, comprises the Allegheny and Monongahela rivers, and the Ohio river from its source to the Ohio-Pennsylvania state line, and their tributaries. Belonging to the government for the purposes of navigation there are now completed and in operation on the rivers in this district 24 dams with 28 locks, the lower four locks on the Monongahela river being double. Of the dams 15 are located on the Monongahela, three on the Allegheny and six on the Ohio river. The Monongahela dams are all of the fixed or stationary type, although dams 2 and 3, recently rebuilt, have adjustable crests 3 ft. high of Chittenden drums. These are built of steel and are capable under certain water conditions of being raised by hydraulic or pneumatic forces over full length of dam in a few seconds. The Allegheny river has two fixed and one movable dams, and the six Ohio river dams are all movable,—of the Chanoine type with bear-trap regulating weirs.

Within a year all of the locks and dams under construction or reconstruction in this district, except No. 5 on the Monongahela river, at Brownsville, have been completed and placed in commission. These recent additions to the local navigation comprise dams 3, 4 and 5, Ohio river, extending slackwater from Merriman's, near the foot of Neville island, about 16 miles to Freedom, Pa., and Nos. 2 and 3, Allegheny river, adding approximately 18 miles to its navigation above Sharpsburg. New No. 3, Monongahela river, at Elizabeth, also was completed and the old structure, about a mile above, largely removed. By means of these extensions there has been provided a continuous navigation, varying from 6 to 9 ft. depth at lower sills of locks from Fairmont, W. Va., on the Monongahela river, to Merrill, Pa., three miles below Beaver, on the Ohio, a distance of 160 miles, and extending up the Allegheny river about 25 miles to Natrona.

This accomplishment of 185 miles of artificial waterway has covered a period of about 70 years, although much of the greater part of it has been acquired or effected in the past 12 years. Early in 1840 the first two locks and dams were put in operation on the Monongahela river, No. 1 within 1½ miles of its mouth, and No. 2 at Port Perry, above Tuttle creek. These were followed in 1844 by Dams 3 and 4, extending slackwater to Brownsville, a distance of 57 miles above Pittsburg. These improvements were established by the Monongahela Navigation Co., a corporation of the state of Pennsylvania, which subsequently also added locks and dams 5, 6 and 7, extending slackwater to the West Virginia state line, approximately 93 miles above the mouth of the river. In the meantime the United States had undertaken the construction of dams 8 and 9, continuing the canalization of the stream to Morgantown, W. Va., which service was finally completed in 1889.

Then for a season improvements on the Monongahela river ceased, and it was not until 1895 that further appropriations were made for the construction of additional works. On that occasion the government undertook as a single project the extension of slackwater from Morgantown to Fairmont, W. Va., comprising six locks and dams. These were completed and placed in operation in 1903, yielding 130 miles of continuous, permanent navigable water of a least depth of from 6 to 8 ft. in the various pools on that stream. In 1897, after prolonged agitation all along the rivers from Pittsburg to the Gulf of the question of freeing the lower Monongahela of tolls, the United States purchased the Navigation company's plant, comprising the seven lowermost docks and dams, at a cost of $3,761,615.46. Enjoying for the first time entire freedom from toll charges the commerce of this river, under the influence of the prosperous times which immediately followed increased very rapidly, creating a demand for extended lockage facilities, particularly in the five lowermost pools. About the same time also the continuous hard usage of the already badly dilapidated navigation company structures began to affect their stability materially, so much indeed that it became necessary immediately to make provision for the reconstruction at least of those in worst condition,

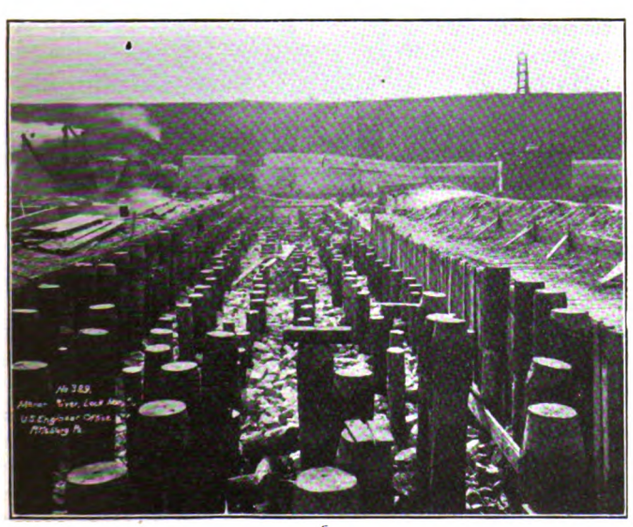
*United States assistant engineer in charge of movable dams in the Pittsburg engineer district.

NEW LOCK NO. 2, MONONGAHELA RIVER, PILES DRIVEN FOR FOUNDATION.

NEW DAM NO. 2, MONONGAHELA RIVER, NEARING COMPLETION, GROOVE ON TOP FOR CHITTENDEN DRUMS.

and the extensive repair of some others. Accordingly locks and dams 2 and 3 have already been rebuilt, and the construction of new No. 5, at Brownsville, is now also well under way. With dam No. 1, at Pittsburg, and the smaller lock at No. 4 reconstructed the needs of the Monongahela river for many years will apparently have been pretty well met.

Prior to 1879 the Allegheny river, although transporting a considerable commerce, seems to have been entirely neglected by the federal government. At that time, however, through the efforts of some persons specially interested in its improvement, congress was prevailed upon to make a small appropriation for the removal of vast deposits of dangerous boulders along its course and the construction of deflecting dikes and low dams closing duplicate chutes at heads of islands and bars. This was followed by similar small appropriations for continuing such work, until in 1885 when, congress becoming convinced of the importance of the stream, determined upon its radical improvement and provided a small sum for the construction of a lock and dam in the vicinity of Herr island, now commonly known as Herr island dam. Considerable delay marked the early history of this structure, partly owing to the meagerness of appropriations and partly because of the general opposition to a fixed dam at that greatly contracted portion of the river located within the limits of the cities of Pittsburg and Allegheny where the banks were comparatively low. Finally, in 1893, the dam, at the solicitation of the municipalities and manufacturers and others located near its site, having been changed to a movable one, similar to Davis island dam, and appropriations having accumulated to an amount justifying a commencement, was placed under construction. Its completion and initial operation occurred in January, 1903, since which time its mantenance and maneuvers have been altogether satisfactory. Following this improvement provision was made for the erection of dams 2 and 3, respectively, at Aspinwall and Springdale. No. 3 was first put in operation in the fall of 1904, but in January, 1906, the dam had to be



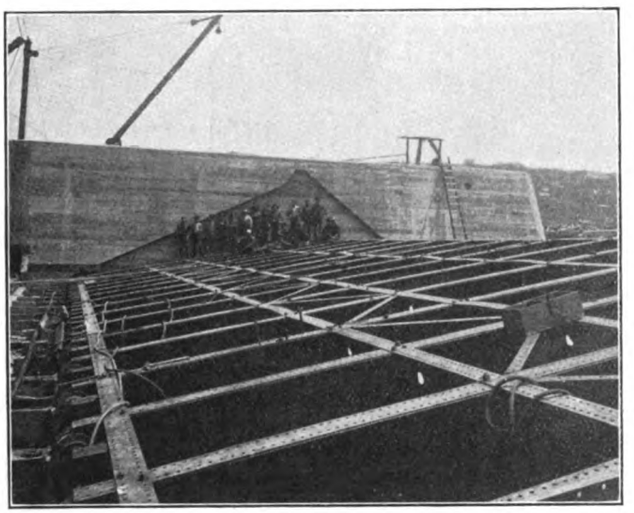
PILE FOUNDATION FOR NEW DAM NO. 2, MONONGAHELA RIVER.

NEW LOCK NO. 2, MONONGAHELA RIVER, SHOWING MONOLITHIC CONSTRUCTION OF CONCRETE LOCK WALLS.

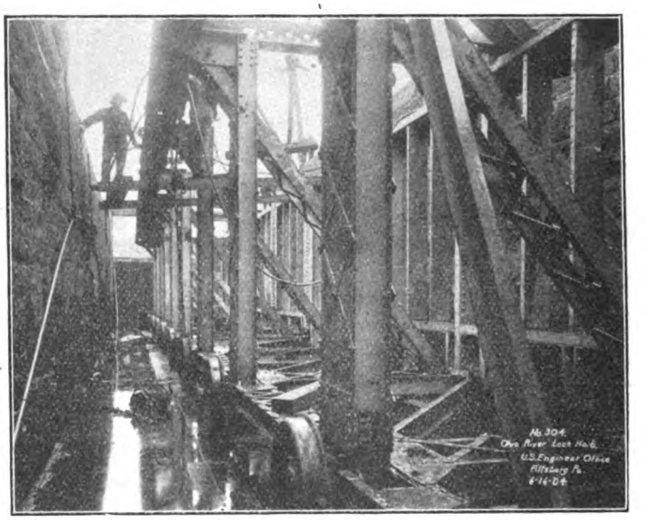
partly destroyed by dynamite, the bank at the abutment having given way. It has since been rebuilt, and together with dam 2 was placed in commission in October last. These improvements extend navigation to Natrona, in former years better known as the "Soda Works."

Briefly these constitute the government's navigation improvements on the two streams forming the Ohio river at Pittsburg. While the Monongahela, with its 130 miles of permanently navigable waters, can boast of a 12-000,000-ton annual commerce the Allegheny must not be rated as an insignificant stream because at the beginning of its radical navigation career it can show only an annual commercial movement of from 2,000,000 to 2,500,000 tons. The stream traverses a splendid valley, exceedingly well adapted for manufacturing purposes. Its mineral resources are large and diversified, comprising coal, building stone, fire clay, limestone, glass sand, iron ore, etc. The present slackwater system does not reach these except a small portion of the coal, but an additional three dams would readily extend navigation into the heart of the mineral region. No funds have yet been made available for the extension of a slackwater above dam 3.

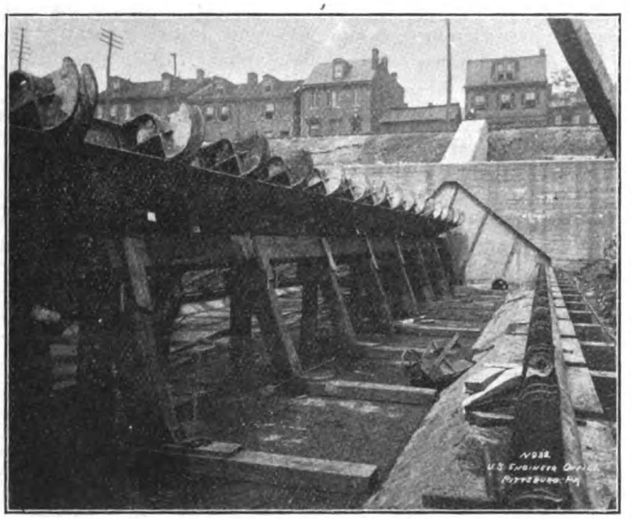
But the improvement of greatest moment in this region is that pertaining to the Ohio river, to which the Allegheny and Monongahela are related rather in the nature of important feeders. For fully three-quarters of a century operations on the Ohio were confined principally to the removal of rock and snag obstructions, the dredging of channels and bars and the construction of deflecting dikes and low dams closing duplicate chutes at heads of islands and bars. Early in the 70's, however, a movement was set on foot to construct a movable dam at Davis island in order to establish a harbor in seasons of low water at Pittsburg, and incidentally to accomplish the initial step toward the permanent improvement of the stream. In 1878 construction work was commenced, but under the prevailing system of intermittent appropriations was greatly delayed, finally resulting



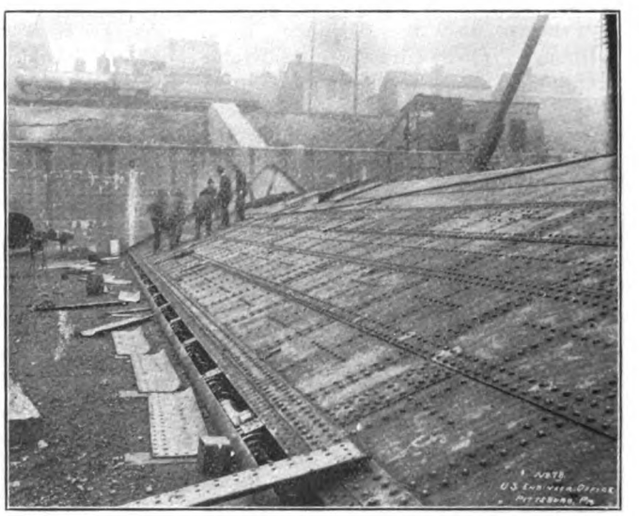
STRUCTURAL STEEL FRAME WORK FOR LOWER LEAF OF BEAR TRAP GATES IN OHIO RIVER MOVABLE DAM.



STEEL FRAMEWORK OF OHIO RIVER ROLLING LOCK GATE (IN GATE RECESS).



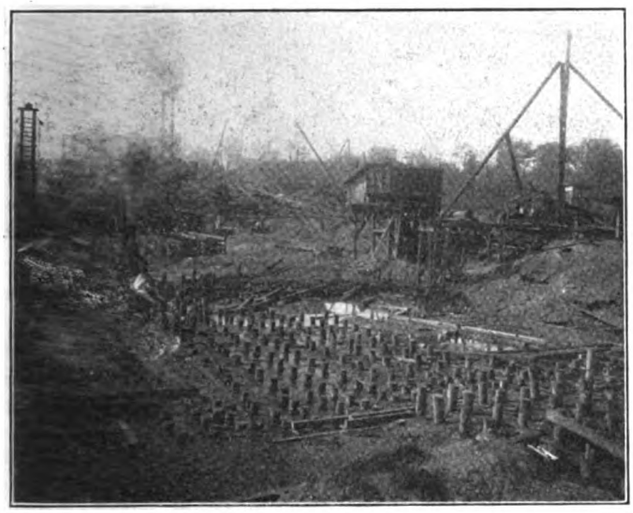
STEEL BEAR TRAP GATE AT HERR ISLAND DAM, ALLEGHENY RIVER, SHOWING FREE END OF LOWER LEAF, HINGE PEDESTALS OF UPPER LEAF, PIER UNDERCUT, ETC.



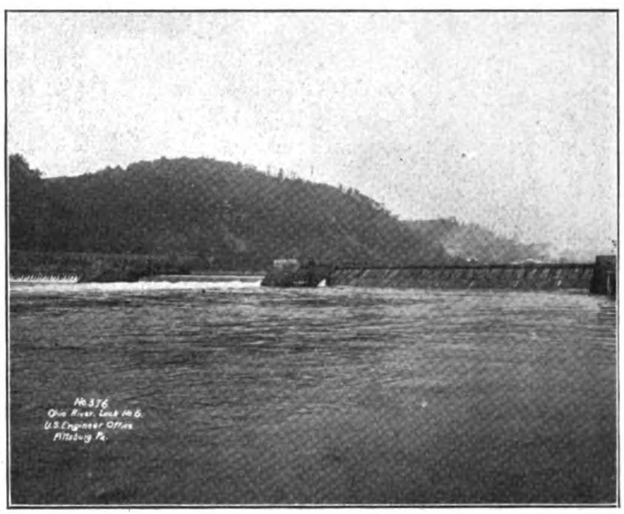
BEAR TRAP GATE IN HERR ISLAND DAM NO 1, ALLEGHENY RIVER, SHOWING STEEL LOWER LEAF NEARLY COMPLETED.

in its completion and opening for use of the public in 1885. It marked a great advance in artificial navigation in this locality, furnishing an excellent harbor during the usually low water intervals of summer and fall, and at the same time presenting no obstruction to the free use of the open river in rises sufficient for the transportation of coal and other heavy bulk freight. It was then apparent that of necessity some time must elapse ere the full fruits of this grand innovation were to be realized, and it was not until 1890 that the next step was taken in what will ultimately culminate in a continuous permanent pool navigation over the entire length of the Ohio river. On that occasion the late Senator M. S. Quay secured an appropriation for the construction of a second movable dam three miles below Beaver, Pa., now designated as dam 6 of the Ohio river series. On this structure work was commenced in 1892, and it was completed and put in operation nearly five years ago. Being a somewhat isolated structure it could be of small value except to form a harbor at the mouth of the Beaver river. However, it furnished an argument for further appropriations for building the intermediate dams between it and dam 1, at Davis island, which was readily accomplished as a single project. About 1898 active construction operations were started on dams 2, 3, 4 and 5, located respectively at Glenfield, Glenosborne, Legionville and Freedom. In 1906 No. 2 was placed in commission; No. 5 followed in the fall of 1907, and in July, 1908, 3 and 4 were put in operation, completing a series of six movable dams at the head of the Ohio, and together with Herr island dam, in the Allegheny, making an initial series of seven large movable dams in consecutive order in this vast industrial center.

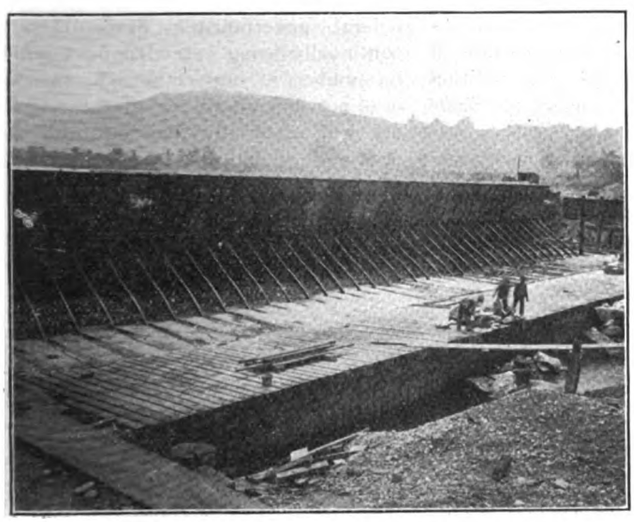
Thus during the past year new lock and dam 3 on the Monongahela and locks and dams 2 and 3, on the Allegheny, have been added to the navigation structures in operation in this district, and all of the Ohio river locks and dams, down to and includ-



DAM NO. 5, OHIO RIVER, PILES FOR CONCRETE FOUNDATION OF BEAR TRAP GATES.



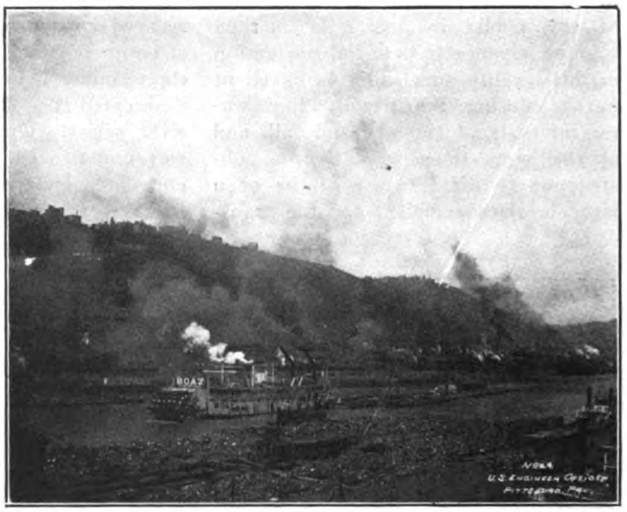
DAM NO. 6, OHIO RIVER, SHOWING ONE 120-FT. BEAR TRAP GATE UP AND THE OTHER PARTLY UP.



DAM NO. 4, OHIO RIVER, SHOWING CHANOINE WICKETS IN RAISED POSITION, FOUNDATION, PROTECTION CRIB BELOW DAM, ALL WITHIN COFFERDAM ENCLOSURE.

LOCK NO. 1, MONONGAHELA RIVER, LEFT HAND LOCK BUILT IN 1840 AND STILL SERVICEABLE AND IN OPERATION CONSTANTLY. THE LOCK IS SHOWN IN THE BACKGROUND OF THIS PICTURE.

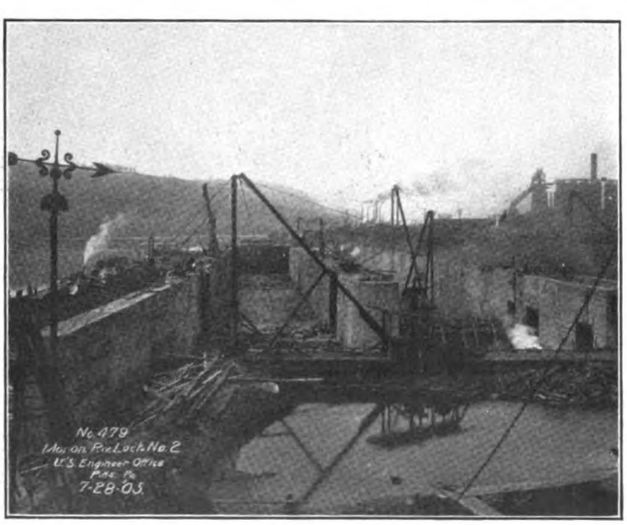
OHIO RIVER LOCK 100 BY 600 FT. USEFUL DIMENSIONS (LOCK NO. 6).



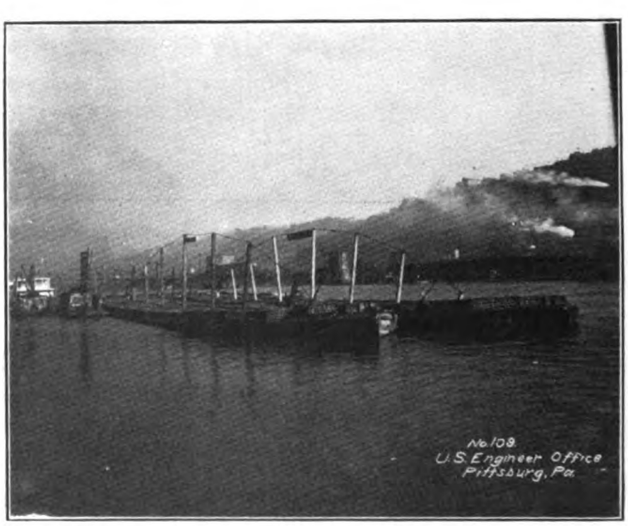
OHIO RIVER COAL FLEET LEAVING THE HARBOR AT PITTSBURG, PA.

ing No. 6, have been made available as one connected system for the movement of commerce. Accordingly nearly 50 miles of navigable waterway have been added in the Pittsburg district, and the facilities for greater commercial activity and convenience vastly increased in the Monongahela river through the completion of new dam No. 3. Practically every manufactory, mine, etc., located in the river valleys of the Pittsburg region has been brought into more or less direct touch with river transportation. That all are unable to avail themselves of the advantages of river shipping at once must, at least to a considerable extent, be attributed to the fact that the improved navigation is still limited, affording relief during the low water season only over such part of the rivers as are rendered permanently navigable by the improvements already accomplished, which now includes only a very short reach on the Ohio river, namely to No. 6 dam. To be sure the purely local business at Pittsburg is no inconsiderable item. But after all it is the long distance or through trade that offers the greatest advantages to the shipper, and this is impossible of attainment save through the addition of a considerable number of dams below No. 6.

In the general subject of navigation as it affects the region round about Pittsburg, the radical improvement of the Ohio certainly presents the principal and at the same time the most interesting problem. With its navigation permanently effected the entire region bordering on its banks opens up to our commercial use and immediately attains its maximum value. At once we are brought into direct communication with nearly a thousand miles of tributary slackwater navigation already provided and maintained by the federal government. Since this is continually being extended on a goodly number of important side streams it is not difficult to see that the benefits will materially increase with the progress of improvements down the Ohio. Necessarily with the enlargement of our water facilities communication will be extended to more largely diversified interests and indus-

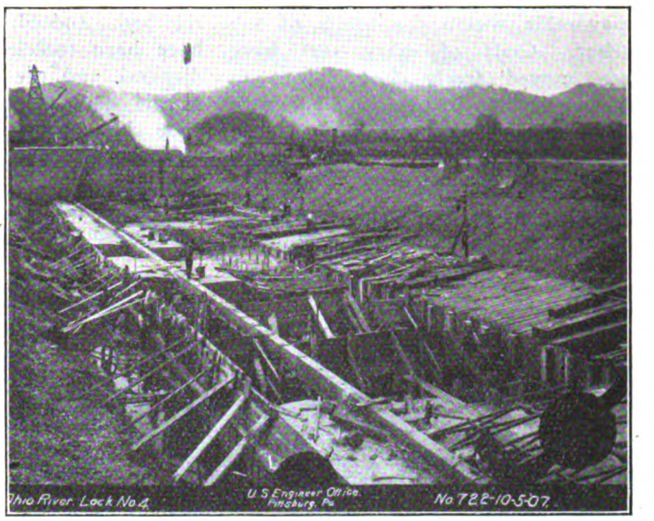


NEW LOCK NO. 2, MONONGAHELA RIVER, LOCK WALLS FINISHED.



MODEL BARGES LOADED WITH STEEL RAILS MOORED IN PITTSBURG HARBOR AWAITING A NAVIGABLE STAGE OF WATER FOR SHIPMENT TO LOWER MISSISSIPPI RIVER PORTS.

ELECTRIC CRANE EQUIPMENT FOR CONSTRUCTION OF NEW LOCK NO. 5, MONONGAHELA RIVER.

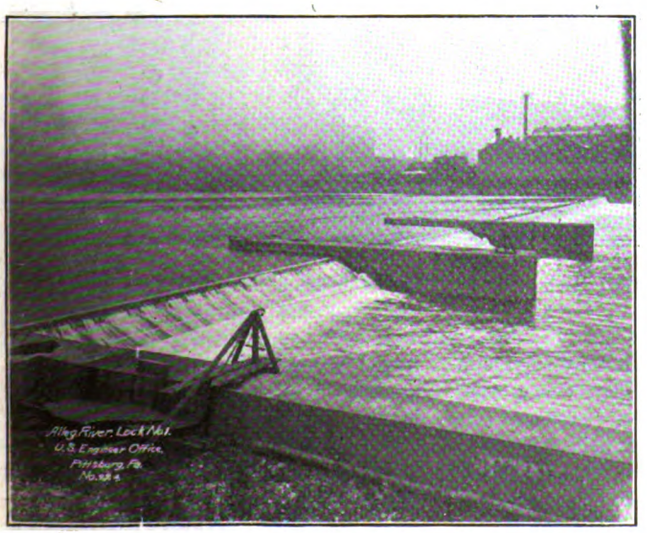


DAM NO. 4, OHIO RIVER, NAVIGABLE PASS FOUNDATION AND PROTECTION CRIB UNDER CONSTRUCTION.

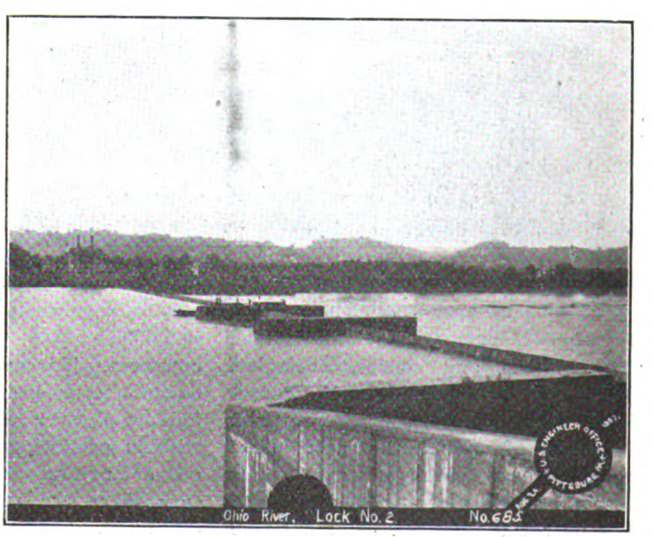
tries, affording both markets for local products and bringing nearer to hand those products of farm and mine and factory which are now reached only by rail, if at all. But above all a more reliable and complete exchange of commodities with the vast Mississippi valley will be realized, and through it with the Gulf and the world-wide inter-oceanic trade, the fulfillment of which will reach its consummation in the completion of the Ishmian canal, whose construction is now happily progressing so satisfactorily.

Reverting to the work already accomplished on the Ohio it is worthy of special note that for nearly a quarter of a century the dam at Davis island has been doing service for the interests in the Pittsburg harbor. So long indeed has the magnificent work of this one improvement continued that we have almost ceased to regard its real worth, and apparently have come to the erroneous conclusion that it does not amount to much and after all conditions would not differ widely were this dam not in existence. Annually as soon as the spring freshets have subsided and the natural stage of water reaches about 6 ft. at Davis island lock the dam is raised and the level of the water rises 12 ft. above the sill of the dam, producing a 6-ft. stage in the Pittsburg harbor. And this process is repeated after each considerable rise of the river so as to maintain a least navigable depth above the dam of not less than 9 ft. So accustomed have we become to observing a good navigable stage in the harbor, sufficient for the movement of vessels of every kind and draught peculiar to this locality at all times, that many forget that without Davis island dam the river at Pittsburg would go almost dry and remain so for long periods at a time nearly every season.

Take the present season as an example. True it has been one of exceptional drought during the past four months. Up to the first of August, however, it was simply a normal summer. Davis island dam was raised immediately upon the decline of the spring rises, which was somewhat later than usual this year, namely on June 10. Since that date there has not been a moment that the conditions for navigation of any



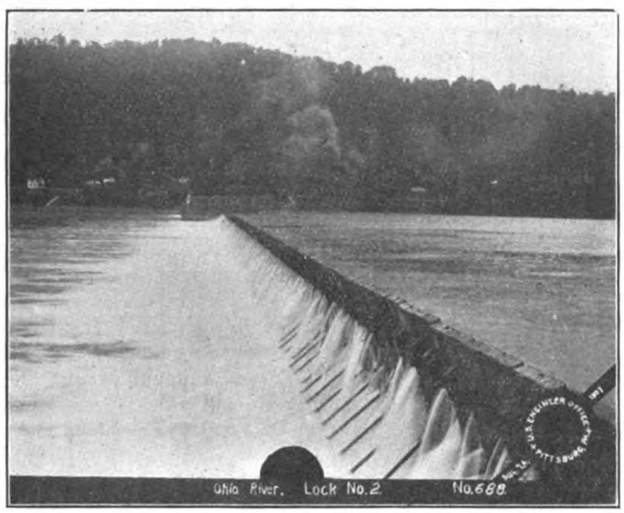
DAM NO. 2, OHIO RIVER, VIEW FROM ABOVE.



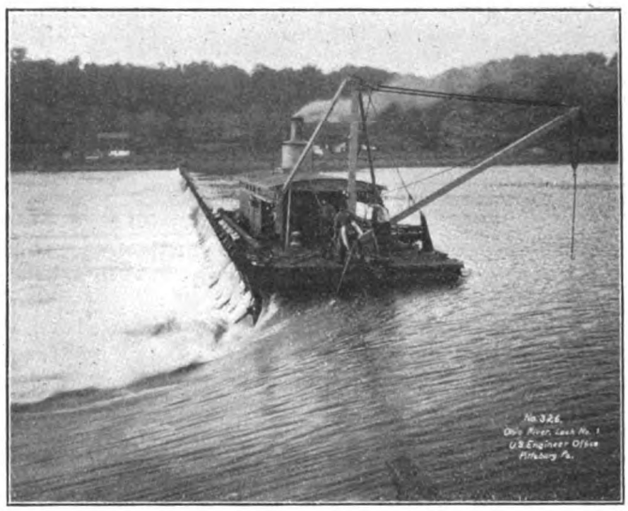
HERR ISLAND DAM NO. 1, ALLEGHENY RIVER, SHOWING TWO 94-FT. STEEL BEAR TRAP GATES IN FOREGROUND AND CHANOINE WICKET NAVIGABLE PASS BEYOND.

character conducted here have been unfavorable within the limits of the harbor. Craft of every sort have been moved freely from place to place, and the harbor is filled with what is probably the largest fleet of heavily laden boats and barges of coal and steel products. Not the slightest inconvenience to navigation is apparent, nor has a complaint been uttered from any source. Imagine, if you can, what would be the conditions without this slackwater pool. For fully four months past there would not have been sufficient water to float much more than an empty skiff over the shallows. Not a single steamboat, or even pleasure motor boat, could have moved about the harbor. All the vast fleets of barges and coalboats would be resting on the riverbed. Indeed, there would hardly have been sufficient water for sewer disposal, and the natural pools within the boundaries of the city would long since have become mere puddles of reeking filth, too unsanitary to countenance.

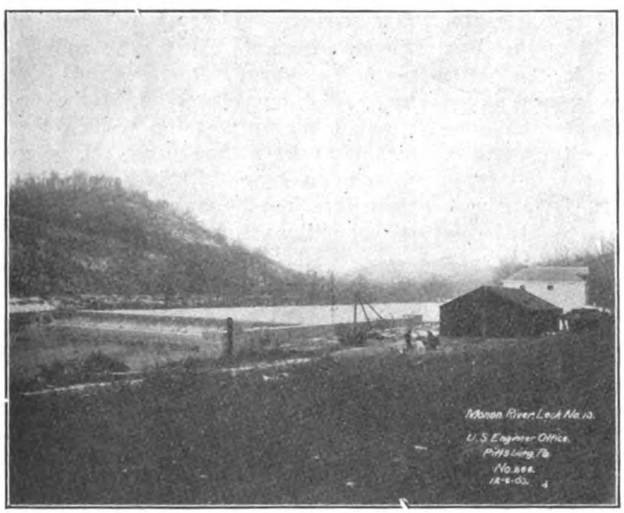
Nor is this instance such an unusual one as to call forth special comment. To some extent such conditions recur practically every year. Seldom does a summer season pass without producing a considerable period of natural low water. To be sure there are moderately dry seasons and moderately wet seasons, and then the two extremes—very wet and very dry. But the latter are not of frequent occurrence. For four months past we have been experiencing one of the most extreme droughts of which there is any record. But after all moderate or normal seasons are greatly in the majority. They are marked by seasonable rains —just enough to keep the ground in proper condition for vegetation. However, during such seasons the rivers frequently fall to a low stage—too low for navigation,—and without the artificial pool at Pittsburg everything in the harbor would be at a standstill. Mills, factories and smaller establishments, even private dwelling houses could not secure coal by water. Sand and gravel for concrete constructions, street paving, etc., now used in such large quantities could not be delivered at landings;



DAM NO. 2, OHIO RIVER, VIEW FROM BELOW. LENGTH OF CHANOINE WICKETS 17 FT. 10½ IN., PROBABLY THE LONGEST IN OPERATION.



RAISING CHANOINE WICKETS OF NAVIGABLE PASS AT DAVIS ISLAND DAM (NO. 1) OHIO RIVER.



LOCK AND DAM NO. 13, MONONGAHELA RIVER, 15 MILES ABOVE MORGANTOWN, W. VA.

DAM NO. 2, ALLEGHENY RIVER, UNDER CONSTRUCTION.

and coal and iron products could not be moored ready for shipment to lower river ports. All this would tend to affect business generally, and above all the sanitary condition of the community would be appreciably deteriorated. Such destructive influences are happily obviated by the existence of a single permanent, reliable slack water construction.

For almost 24 years this structure has served well the purposes for which it was intended. It required a few years to accomplish satisfactory results. The original structure was experimental in many respects, notwithstanding the Chanoine type of dam had been tested for several years on small streams in France. Little by little its adaptability to the larger conditions of a great river, with its sudden rises and freshets, drifts, ice, etc., has been applied, until in recent years it has met the needs of the community quite efficiently. These results have not come by chance, but have required much thought, anxiety and labor on the part of those in charge and considerable expenditures by the government. It is also a significant fact that while the service has been improving the physical condition of the entire structure has materially depreciated. Much of this depreciation has been in large measure due to the experimental nature of the structure, its working plant and operation. One thing after another was tried, often only to prove a failure. Many experiments were costly, frequently ending in a complete loss. Nevertheless the service was generally maintained and in the main improved, until now it has reached a state eminently satisfactory. As instances in changes of operating methods, formerly, and indeed for many years, it was thought necessary to lower the wickets as soon as a rise became imminent and slightly in advance of its approach. This frequently occasioned through miscalculation of the progress or extent of rise a premature or even unnecessary lowering, causing the harbor level to decline as much as 2 or 3 ft. below its normal elevation several hours in advance of the proper time for pool disposal, and before sufficient water had reached the harbor to maintain its normal condition. This policy was often detrimental to navigation, at least causing great inconvenience, and occasionally slight losses. All this has been changed. Now the dams are left standing as long as possible against advancing rises, until they are literally forced down by their onward movement. Consequently the heads of the pools are generally so precisely regulated as to render the transformation from pool to open river unobservable. Again the original method of maneuvering Davis island dam alone precluded consideration of every interest save itself, and to a certain extent, of course, navigation. Now, as must appear evident, there being a series of seven such dams in consecutive order, each must be operated mindful of the interests of the rest. Nothing short of such a policy would ever serve to accomplish their successful lowering without injury to some and probably a complete blockading of navigation. These two noteworthy examples might be multiplied many times in the history of the Davis island structure alone.

Doubtless many have conceived the idea that the movable dams having been designed to meet the conditions obtaining on our local rivers, all that is necessary is to build them and set the wheels in motion and the structures will automatically do the rest. Nothing could be farther from the truth. The Ohio river, even at its source, is a large stream, which to control at any stage and by any means is no mean undertaking. Rivers of such magnitude and velocity do not stop in their gulf-ward flow without offering resistance. Every inch of closure to obstruct their course must literally be fought out until the entire passageway has been shut off and the water above the dam lies conquered in a placid pool. So also when released it again asserts its power with ever increasing force until its pent up energy has been expended and a normal condition attained. No matter as to the character of machinery introduced for such operations the personal element after all remains all-important and indispensable. The maneuvering of the dams must be performed by the operating forces to meet the varying conditions, and as they change the methods of doing the work must change. No fixed rule can be laid down for the performance of the greater part of this work. It must be done as circumstances demand.

For some time the navigation interests and the community in general have awaited the completion of the upper Ohio river structures. Doubtless they might have been finished much sooner had the means for their construction been more promptly provided, and especially had the first definite project been carried out. When the earlier dams were constructed and provision made for those immediately following they contemplated only a 6-ft. navigation. Not until No. 6 was completed and dams 2 and 5, inclusive, were well under way did it suddenly occur to those whose interests were most directly involved that the pools should afford ample depth to accommodate the deepest draught vessels in general use in this locality. Immediate steps were taken to accomplish this end. Necessarily this meant increased delay in securing congressional authorization, additional funds to meet the cost of alterations and time for performing the work. Parts of the work already in place were removed, reshipped to factory, changed and replaced; extensive modifications at the works were made, often at great disadvantages owing to the absence of cofferdams; and unbuilt portions of structures were redesigned and constructed to effect a 9-ft. navigation. No doubt had all this been foreseen and covered in the original project not only much time, labor and cost could have been saved, but the structures themselves in many respects would have been better and generally more satisfactory. However, the change proved most worthy, and notwithstanding its responsibility for some undesirable features causing extra care, labor and expense in maintenance and operation, navigation has gained a material advantage right at the outstart of the vast canalization project of the Ohio river, which will unquestionably be carried out through its entire length. Nor is this 9-ft. depth merely a theoretical one not available for the uses of navigation. Any craft drawing not exceeding 9 ft. may now navigate safely from Pittsburg to dam 6, without danger of grounding if the channel is closely followed.

(To be continued.)

MASTERS AND PILOTS ELECT OFFICERS.

The National Association of Masters, Mates and Pilots of Steam Vessels, at its annual convention in Washington, Jan. 23, elected officers for the ensuing year as follows: President, John H. Pruitt, of Brooklyn; first vice president, A. L. Pease, Portland, Ore.; second vice president, A. R. Mackey, Pittsburg, Pa.; third vice president, William Sommers, Camden, N. J.; counsel, L. B. Dow, New York city; secretary, C. L. Warwick, Baltimore; treasurer, A. B. Dowlin, Jersey City, N. J.

THE MARINE REVIEW

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February 4, 1909.

LIFE PRESERVERS ON MOTOR BOATS.

Mr. Frye has introduced in the senate and Mr. Greene in the house, a bill requiring life preservers to be carried on motor boats. The bill provides that there should be at least one life preserver for each person on board and that they should be so stowed that their position may be known and that they may be readily accessible. The owner shall be liable to a penalty of $10 for each life preserver lacking or improperly stowed. The bill has already been reported unanimously by the committee on commerce of the senate and committee on merchant marine and fisheries of the house. It is the outgrowth of a number of distressing accidents which happened to motor boats during the past season when a number of lives were lost. Undoubtedly in the majority of cases life would have saved had preservers been within reach. Obviously one does not have to dwell on the dangerous qualities of naphtha and gasoline. When ignited on a motor boat there is practically no recourse but to jump overboard.

The subject has already been considered by the marine commission appointed by the president last spring to formulate rules for safe-guarding life at sea and it will be incorporated in the report of the commission. However, this report will be quite voluminous and as it is quite unlikely that action could be taken upon it during the present brief session, the measure was accordingly introduced to provide a specific remedy. Of course, the indiscriminate introduction of bills regulating the navigation of motor boats would seriously cripple one of the great growing industries of the country. It is therefore gratifying to announce that the marine commission contemplates nothing further until its report is presented, when abundant time will be given to everyone to digest its provisions and to suggest amendments.

COMPULSORY WIRELESS AND OTHER DEVICES.

As wireless telegraph equipment aboardship has been instrumental in preventing the destruction of considerable life and property at sea in the past few years there can be no doubt that the recent narrowly averted double disaster off Nantucket (and the enthusiasm of the press) is responsible for the sudden demand for wireless equipment on all ocean-going passenger steamers, or those making trips extending beyond a certain limited mileage. Those in close touch with ships and shipping are aware that there is hardly a day passes in which the "wireless" does not play a prominent part in getting assistance for some helpless craft, so fully appreciate its usefulness. It is only when some such disaster as the collision between the liners Republic and Florida occurs practically in our waters, however, that those not intimately acquainted with the mariners' life awaken to what —in justice to all concerned—are absolute necessities in the equipment of the modern passenger vessel.

It is appalling to think that there are trans-Atlantic steamship owners not sufficiently progressive, to put it mildly, to have equipment of this kind installed on their vessels, and that these vessels, with about one thousand souls aboard, when out of the range of vision of passing craft belonging to more progressive owners, have a slim chance of obtaining any assistance they may urgently need. The loss of the Republic, one of the trans-Atlantic ferry's finest, demonstrates the fact that the non-"wireless" vessel, under certain conditions, is a menace to modern navigation in the steamship route.

To say that passenger vessels were considered a triumph of the shipbuilder's and navigator's art ten years ago, before the Marconi wireless came into force on the Atlantic, is to make a mighty poor excuse for ignoring the needs of the present day. Steamships were considered the acme of safety before such improvements as water-tight bulkheads, double bottom, twin-screws, etc., were known in the shipyard. Perhaps it is just as well that competition is to a great extent responsible for the installation of each device conceded to be of practical value to the prevention of loss of life at sea. The intending passenger these days, when purchasing his ticket, seldom fails to make some inquiries along this line, with the result that the company owning the best equipped vessels usually gets his patronage.

The introduction within the past few years of submarine signalling apparatus has done much to lighten the burden resting on the shoulders of the navigating officer. Many accidents due to fog have been averted, and many hours—formerly spent in endeavoring to "pick up" a lightship or other point —saved by the use of this device.

A clause in the latest issue of Rules and Regulations laid down by the Steamboat Inspection Service practically forces the shipbuilder and owner to recognize the fact that there are several commendable boat-handling devices on the market and that the lifeboat launching apparatus hereafter installed will have to be of such design that boats can be rapidly and safely

launched; a time limit being given. To a large percentage of owners' credit be it said, however, that so far as they are concerned the framing of this rule was not necessary. Compulsory boat drill at sea has done much to allay the fears of the timid passenger, and, when boats are fitted with such apparatus as permits of their rapid and safe handling, the passenger's confidence in the company is still farther augmented.

There are several systems of fire-fighting apparatus aboard-ship, but how many vessels are equipped with a device which will unfailingly announce the presence of fire in its incipiency? How much longer has the ship master to depend on the keen sense of smell or sight of the various members of his crew to detect the smoldering blaze? A recent fire aboardship was discovered through smoke being observed rolling from a hatch. In fighting the fire the master and mate of the vessel were overcome, the fire itself being extinguished only after many hours of strenuous effort on the part of the crew. This was a fire which, according to report, must have been smoldering some considerable time. Fire at sea is one of the few things which strike terror to the heart of the sailor. There are devices at present in use aboardship which not only announce the presence of fire in the freight or other compartments but will give warning of a rise in temperature in these compartments and so prevent any possibility of an outbreak. We have read letters written by masters, mates and engineers, commending these devices, letters from the men who were aboardship when the device was the means of saving the vessel and lives of the crew. Is the day to come when ship owners will be compelled to adopt some such device, or will they still continue to depend on the pluck and endurance of the masters and crews of their vessels to extinguish any conflagaration which may break forth?

The adoption of the wireless should no longer be left to the choice of the shipowner. Neither, for that matter, should the adoption of the devices above mentioned. Let us hope that the day is not far distant when, so far as the vessels of our merchant marine are concerned—the best of equipment will be none too good.

Co-Operative Insurance Plan of Lake Vessel Owners.

Following the meeting of vessel owners two weeks ago in Detroit to provide a plan for, so far as possible, regulating the depth of loading ships and improving the discipline of rules in regard to navigation, the advisory committee held its first meeting in Cleveland on Monday and Tuesday. The full committee, consisting of J. S. Ashley, chairman; H. Coulby, J. H. Sheadle, W. C. Richardson, G. A. Tomlinson and D. Sullivan, were present. Mr. T. T. Morford, of Buffalo, attended the meeting on behalf of the package freight lines, though the package freight companies are not, as yet, parties to the agreement. The movement is beyond all question the most important and significant that has ever taken place on the great lakes, owing to its fine moral fiber.

Some action of this kind seemed to be compelled by the increasing number and size of the ships, the liability to load deeper than is safe in the shallow connecting waters and for some of the harbors, and it is one which has been contemplated for a good while back. It is a movement which could not be undertaken by the Lake Carriers' Association as being beyond its province, but, nevertheless, the co-operation of the Lake Carriers' Association is expected and may be said to be assured, which is considered desirable in order that there may not be rules which could come in conflict.

The whole idea will be to follow absolutely government rules so far as they apply, and simply do everything possible for their best observance, and then to deal with those matters, not of overloading, but of loading too deeply for channels and other cognate subjects, all with a view to making for the safety of life and property and the lessening of losses and damages. It is the positive opinion of vessel owners that by concerted, intelligent action a great deal may be accomplished in this direction.

As one of the means to carry out the matter, the plan involved that each of the owners should withhold from insurance 5 per cent of the insurable valuation and put that into a loss-sharing or inter-insurance plan.

This feature, naturally, occupied much of the time of the advisory committee at their session. The first and most important question decided was whether the plan would be better accomplished by making an organization of their own to carry out the detail work of this department of the plan, but discussion developed that the details are so immense and would require so large a force in such an organization that it would not be wise to attempt it at the outset, but rather to employ the services of some established insurance organization of high character to transact these details. That having been determined, selection was made of the well-known firm of Willcox, Peck & Hughes, Inc., in New York City, where the business will be transacted through that concern as attorney-in-fact for the owners under the supervision of the advisory committee, who are thus relieved of details while retaining the entire control of the matter.

Mr. J. S. Ashley was made permanent chairman of the advisory committee and Mr. W. C. Richardson, of Cleveland, was made treasurer, by whom all funds will be received and disbursed. Mr. Harvey D. Goulder was appointed as counsel for the committee.

The outline of detail is for all vessel owners to come in, the terms of participation being governed according to those which obtain in the insurance which they place in the ordinary course of insurance.

Without finally deciding the point, the consensus of opinion was to confine this feature to straight hull risks, eliminating what is known as "protection and indemnity insurance," which can be obtained by separate and distinct policies and it was thought would lead to confusion in getting at the real matters concerning the parties who go in, i. e., the safety in the loading and navigating of the ships themselves, and to formulate statistics for general use as applicable to the proper cost of insurance, with so much of avoidable damage eliminated as possible.

It is the general belief that the effective carrying out of the plans now being formulated will be to later so materially cut down the losses and damages as to work a large reduction in the necessary cost of insurance.

The fact that of all the insurable American and Canadian tonnage on the great lakes, about 75 per cent has already pledged, and that assurances are at hand that more than half and perhaps all of the remainder will have pledged before the first of April, when

the plan goes into effect, and the character of the advisory committee, composed, as it is, of the foremost and most active lake operators and managers from Duluth to Buffalo, on both the American and the Canadian sides, assure effectiveness in the carrying out of the plan by the committee and their full support by the owners.

This plan and its working out in no sense or degree interferes with or affects the owner's placing the 95 per cent of his insurance valuation precisely as he has done heretofore, and leaves the insurance business of the lakes to be conducted precisely as it always has been, except that from that regular course of business this 5 per cent is withheld and put into this arrangement to aid the purpose of the general plan.

DRINKING ENOUGH WHISKY TO FLOAT A BATTLESHIP.

The *Scientific American* in a reply to a correspondent in "Notes and Queries" explains at some length how the common saying that "drinking enough whisky to float a battleship" does not involve any great feat of absorption, not more than a few gallons in fact. Briefly, the volume, or amount, of the fluid surrounding the vessel has nothing whatever to do with the problem. It is the height, or depth, of water above the ship's bottom, which balances her weight, by exerting a pressure on her bottom corresponding to the height of the column of water. As an illustration, suppose a ship 200 ft. long, 30 ft. breadth, with a draught of 10 ft. For simplicity suppose the ship to be a rectangular box. The weight of the ship is just equal to that of the volume of water displaced, which is found by calculating the volume in cubic feet of the immersed body and multiplying by the weight of a cubic foot of water, which for fresh water is 62.4 lbs. Thus we have $200 \times 30 \times 10 \times 62.4 = 3{,}744{,}000$ lbs.

The weight of a column of water 1 in. sq. and 1 ft. high is 0.433 lbs., or, 10 ft. high, 4.33 lbs. Therefore we have a pressure on each square inch of the ship's bottom of 4.33 lbs. The area of her bottom is $200 \times 30 \times 144 = 864{,}000$ sq. in. If this is multiplied by the pressure of the 10 ft. column of water we have $864{,}000 \times 4.33 = 3{,}744{,}000$ lbs., the weight of the ship.

So that if we imagine our ship placed in a dock, or basin, only large enough to contain her with the thinnest possible film of water between the ship and the sides and bottom of the basin, the conditions are in no way altered from those of the ship in the open sea.

It is easily evident then, that an ordinarily abstemious person may, without difficulty, in the course of an ordinary life, stow away enough whisky to float a battleship without inconvenience or making his reformation an object to the most rigid prohibitionist. So that after years of slander, Jack Tar comes into his own as a pattern of moderation.

AN IMPROVEMENT FOR AUXILLIARY BOILERS.

S. D. Brear, 1817-19 Dock street, Tacoma, Wash., is manufacturing a simple improvement for upright, auxiliary steam boilers which is designed to materially increase their efficiency. The improvement consists of a sheet iron jacket which

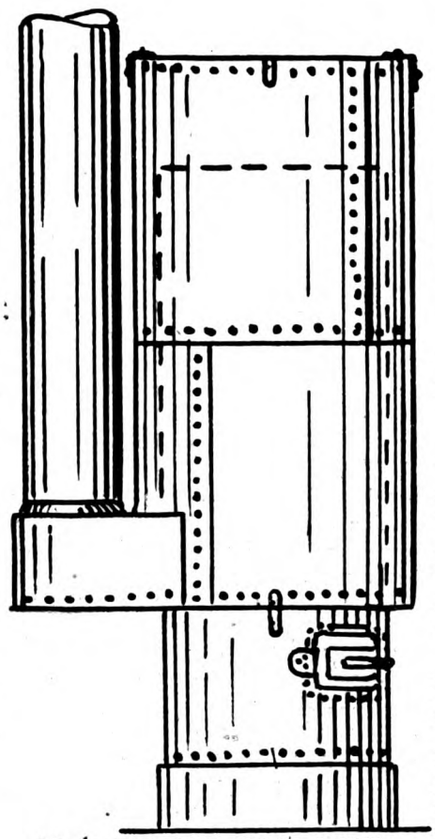


FIG. 1—DIAGRAM OF BREAR'S JACKET.

entirely surrounds the boiler above the fire box. The jacket is made of riveted No. 12 or 14 gage steel plates. On an ordinary boiler about 3 ft. in diameter the jacket is about 6 in. larger in diameter than the boiler and about a foot higher. The lower end of the jacket is closed so that it forms a tight box surrounding the boiler. Out of the lower end of the jacket the smoke flue is taken.

The area of the annular space between the boiler and the jacket is larger than the area of the flue. The smoke and products of combustion come up through the flues of the boiler in the usual manner and are thence led down between the boiler shell and the jacket to the bottom where they leave through the flue. The jacket therefore amounts practically to increasing the water heating surface by the area of external shell above

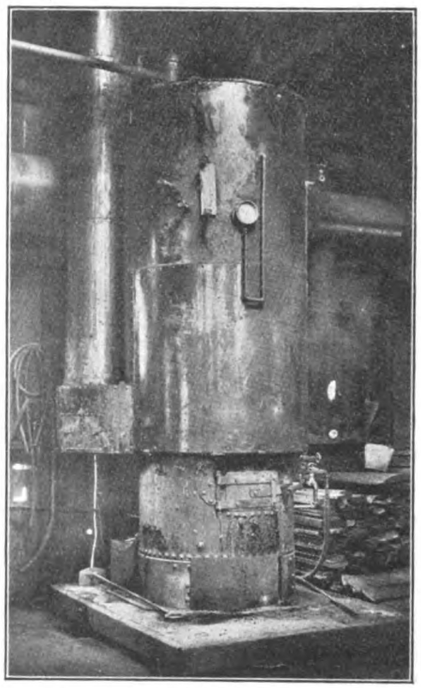


FIG. 2—BREAR'S JACKET AS APPLIED TO AN ORDINARY HOISTING BOILER.

the fire door. For a boiler 3 ft. in diameter and with a height of 4 ft. above the fire door this area is 37.7 sq. ft. The capacity of the boiler, it is claimed, is increased 16 per cent by means of the jacket; that is, a 30-H. P. boiler with a jacket can be rated at 35 H. P.

The jacket also tends to prevent fluctuations in the temperature of the upper part of the boiler and the flue sheet. This prevents leaks, increases the life of the boiler and prevents burned out flues. No external, cold air can come directly in contact with the boiler. The top of the jacket is hinged and may be removed so the flues and tube sheet can be easily examined.

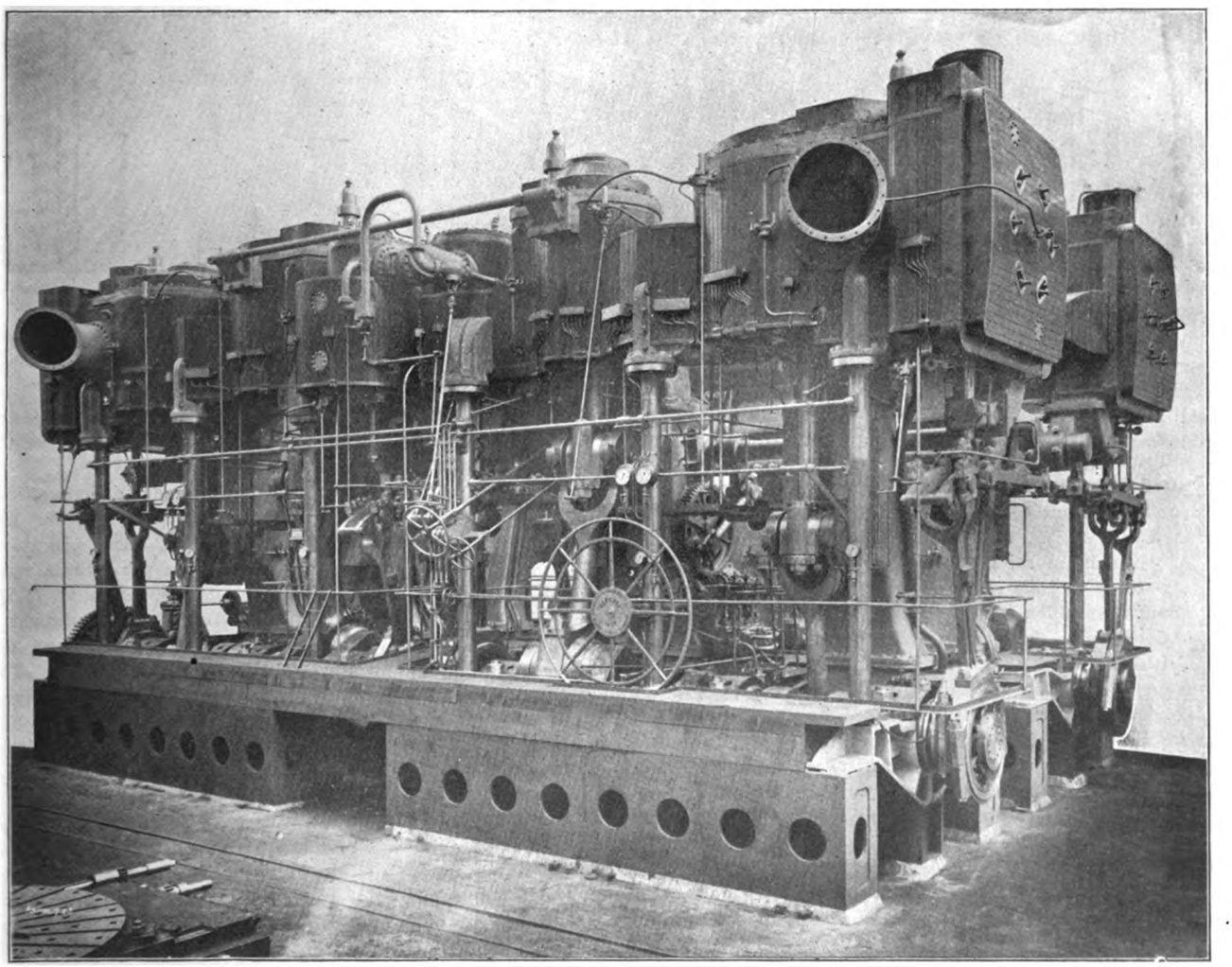
The Manitowoc Dry Dock Co. are sending out invitations to the launching of the steel steamer United States at the yard of the Manitowoc Dry Dock Co., Manitowoc, Wis., on Feb. 22. The launching will occur at 2 p. m., and luncheon will be served in the shipyard offices.

The freighter building at the Cleveland yard of the American Ship Building Co., for R. P. Ranney, of Cleveland, will be named in honor of A. S. Upson, president of the Upson Nut Co.

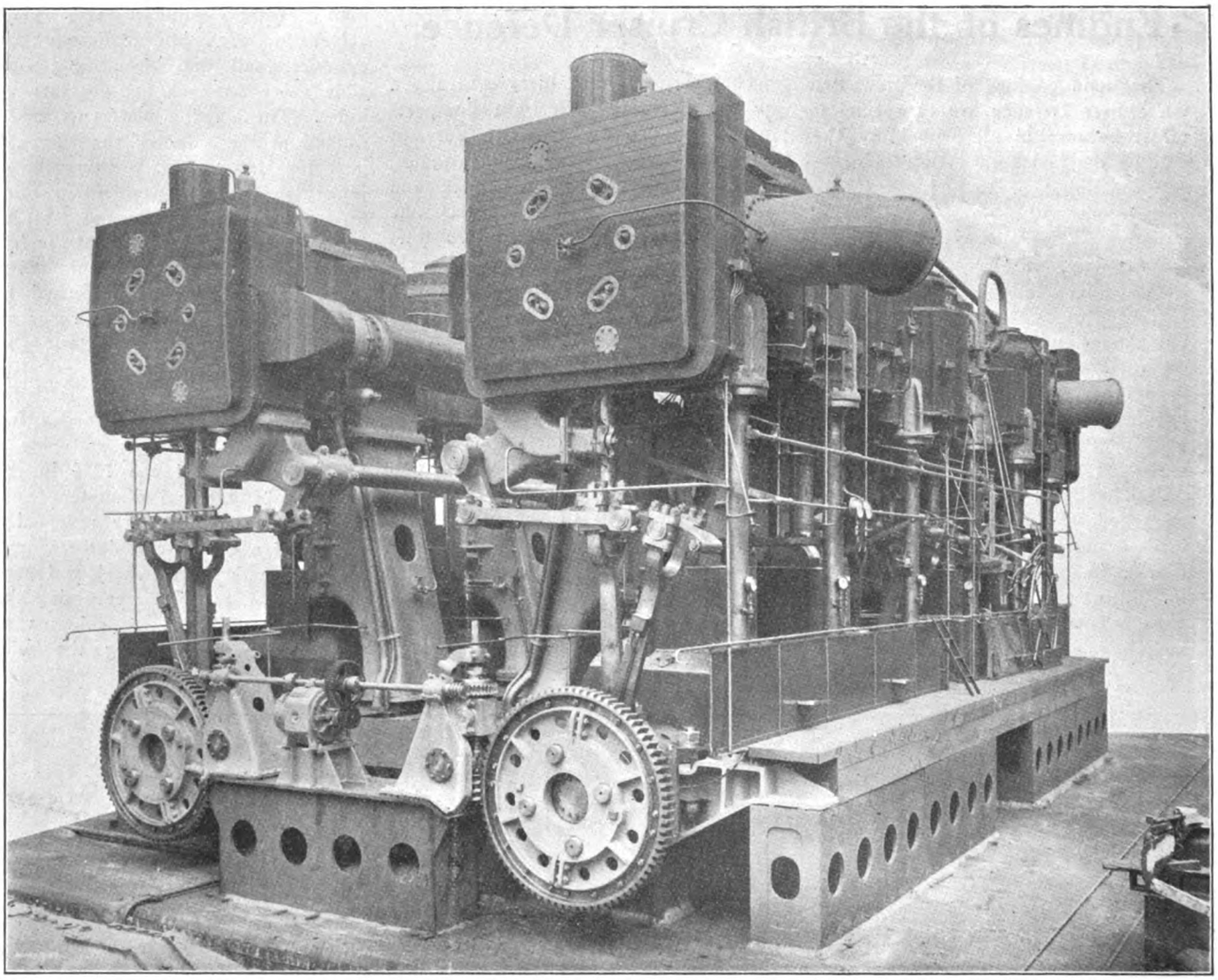
Engines of the British Cruiser Defence.

The main engines of the new British cruiser Defence are of special interest because in all probability they will be the last set of engines of the reciprocating type to be built for the British admiralty, on account of the adoption of the steam turbine for naval vessels. The Defence was built by Scotts Ship Building & Engineering Co., Ltd., of Greenock, and the principal dimensions are as follows: Length, 490 ft.; breadth, 74 ft. 6 in.; mean load draught, 26 ft.; weight of hull, including armor and backing, 8,215 tons; displacement on load draught, 14,600 tons; estimated horsepower (forced draft), 27,000 I. H. P.; corresponding estimated speed, 23 knots; coal capacity at load draught, 1,000 tons; armament, four 9.2-in. breech-loading guns, 10 7.5-in. ditto, and 16 small quick-firing guns. Total estimated cost of ship, including guns, $6,885,535.

The propelling machinery is arranged in two separate watertight compartments and consists of two sets of four-cylinder, triple-expansion engines, balanced on the Yarrow-Schlick and Tweedy system. Each set has one high, one intermediate and two low-pressure cylinders, all fitted with liners and steam jacketed. The diameters of the cylinders are, respectively, one of 40⅝ in., one of 65½ in., and two of 74⅝ in., with a stroke of 48. They are capable of developing collectively 27,000 I. H. P. at 125 R. P. M., with a steam pressure at engines of 250 lb. per square inch. The cylinder covers and pistons are of cast steel and conical in form. Both sides of the pistons are machined, as is also the case with the inside of the covers and the cylinder ends. Stephenson's link motion is adopted for working the valves, which consist of one piston valve for each high-pressure cylinder, two piston valves for each intermediate-pressure cylinder, and one flat treble-ported slide valve for each low-pressure cylinder. The starting platforms are arranged at the sides of the ship. All gear for starting and working the engines is led to convenient positions on these platforms. Forged steel columns support the cylinders at the front of the engines. The back columns are made of cast iron of the usual box section, and are formed to carry also the crosshead slipper guides, which have large heating surfaces. The crank shaft for each engine is in four pieces, each piece being forged from the solid. The journals and pins are bored hollow, and are 19⅞ in., and 27¼ in. in external diameter respectively. The engines are reversed by means of a double-cylinder steam engine, through worm-wheel and screw gearing, connected to a reversing shaft supported off the back columns and cylinders, and extending the whole



ENGINES OF THE BRITISH CRUISER DEFENSE.



ENGINES OF THE BRITISH CRUISER DEFENSE.

length of the engines. Worm-wheel and screw gearing driven by an electric motor is supplied for turning the engines when overhauling.

Two condensers, of oval form, are fitted in each engine room. The total cooling surface of the four condensers is 32,400 sq. ft., and the total length of ⅝-in. brass tubing in the condensers to give this cooling surface is about 38¼ miles.

Contrary to the usual practice of the British admiralty, the exhaust steam from the engine passes through the condenser tubes, and is condensed by the circulating water passing over the outside of the tubes. Two centrifugal pumps in each engine room supply the circulating water, the pumps being so arranged that either can pump to either or both condensers in one engine room. The vacuum in the condensers is maintained by two sets of twin air pumps made by Messrs. S. & J. Weir, Ltd. The hot water is also drawn off by these pumps, and pumped through gravitation filters into the feed tanks. One main and one auxiliary feed pump are fitted in each boiler compartment. For making up lost water, two evaporators, with distilling condensers, feed and brine pumps, etc., are also fitted in each engine room.

Exclusive of the main propelling engines there are 56 steam engines and 40 electric motors supplied and fitted by the machinery builders throughout the ship.

The boiler installation consists of 24 water-tube boilers of the Yarrow type, made by Messrs. Scotts, with a working pressure of 275 lb. per square inch. They are arranged in five water-tight compartments in the ship, with a central stokehold running athwartship in each compartment. The steam collector of each boiler is 4 ft. 2 in. in internal diameter, and 11 ft. long. The heating tubes are of solid drawn steel, 1¾ in. in internal diameter by about 8 ft. long, expanded at each end and headed in the thick tube plates of the steam and water drums.

The Defence completed her official trials on Nov. 30, last. On the full power trial of eight hours' duration, the mean revolutions per minute were 127, and the engine indicated 27,570 H P. The Defence easily attained a speed of 23 knots and exceeded her designed power by 570 I. H. P. The coal and water consumption per unit of power were also satisfactory. The vessel also ran the prescribed trials at one-fifth and four-fifths power to determine the radius of action. On the latter of these, of 30 hours, continuous steaming, the power approached 19,500 I. H. P., with the engines running at 115 revolutions and a speed amounting to 20.9 knots. The results were regarded as extremely satisfactory.

FLORIDA TO BE SOLD AT AUCTION.

The Lloyd Italiano Co., owners of the steamship Florida, which rammed and sank the White Star liner Republic off Nantucket, have filed a petition asking that the United States government take possession of the Florida, and accordingly she has been seized by a United States marshal. It is the purpose of the Lloyd Italiano to have the Florida held by the government until such time as a perfect title can be given to a trustee appointed by the court. He is then to sell the vessel at auction and deposit the funds with the court.

If in the end the liability of the Florida's owners is proven and they should be held accountable for compensation for damages to the Republic's owners and passengers, it would be from this fund, representing the damaged value of the vessel and her freight and passenger moneys pending, that such claims as awarded would be paid. Thus the granting of the petition acts as a stay to any suit against the Florida, whether the major suit of the owners of the Republic for the attachment of the vessel or any minor suits by freight owners or passengers, singly or in combination.

The White Star line has already libelled the Florida for $2,000,000 damages. As the Republic is on the bottom there will be no cross libel by the Italian company, but it will declare that the blame for the collision belongs to the Republic. It has also filed a petition asking that the liability of the Florida be limited to $224,000, the value of the Florida and the freight and passenger moneys due.

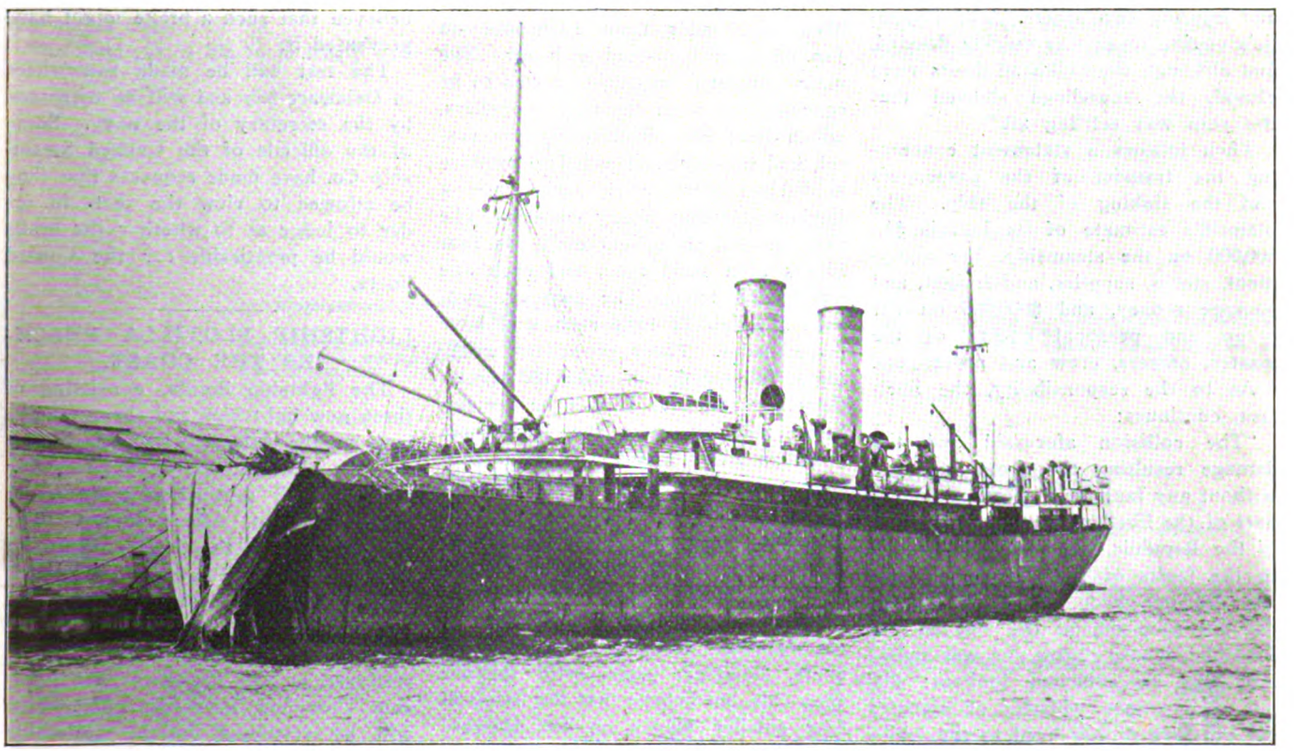
There will be no cross libel because the Republic is on the bottom, and there is nothing for the Italian company to libel. They will fight the action of the White Star Co., however, and declare the blame for the collision belongs to the Republic.

After describing the Republic as having been staunch and seaworthy and properly manned before the collision, the White Star statement as filed in court goes on as follows:

"During the night of Jan. 22 and the early morning of Jan. 23, the ship was on a course S. 84 degrees E. true, which she was steering just previous to the collision. During the night the weather was clear, with patches of haze, and the weather so continued until about the time of the collision. On account of the patches of haze, the engines were kept at reduced speed and under a stand-by order, and fog signals were blown. After four o'clock a. m., while proceeding in this manner, the master, second and third officers, quartermaster and a seaman were on the bridge, with two lookouts in the crow's nest, all of whom were vigilantly attending to their duties.

"About 8:45 a. m., a signal of one whistle was heard and reported on the Republic's port bow. Immediately by the orders 'stop' and 'full speed astern' were given to the engine-room, and the helm was ported. The orders were at once obeyed, and at the same time a signal of three whistles was given.

"Shortly afterward there was made out, broad off the Republic's port side, the loom of a number of bright lights, apparently from a large vessel (which proved to be the Florida), both of whose side lights soon came into view. The Florida was bearing down on the Republic at high speed, threatening to strike the Republic a right-angle blow amidships.



THE STEAMSHIP FLORIDA AS SHE LOOKED AFTER RAMMING THE REPUBLIC.

ATTEMPT TO ESCAPE.

"In the effort to escape the blow, the master put the engines of the Republic ahead; but the Florida came on at a high rate of speed, apparently swinging under a starboard helm, and crashed head on into the port side of the Republic, penetrating into the engine room. The collision occurred at about 5:30 a. m., in latitude 40

degrees 17 minutes north, longitude 70 degrees west, being a little more than 26 miles southwesterly of Nantucket Shoals lightship.

"The stem of the Florida struck the Republic's port side nearly a square blow and made a narrow vertical cut, extending well below the water line, straining and starting the bulkheads. Under her momentum, the Florida's bow, where it struck the side platings and frames, was crumpled back some 30 ft. The top of the Florida's bow passed above the Republic's side plating, so that it reached and wrecked the cabins along the saloon and promenade decks, causing the death of two passengers and injuring two others. The Republic's engine room was quickly flooded, and although the bulkhead doors were closed, the soundings showed that the ship was settling aft."

Then follows a statement concerning the transfer of the passengers and the sinking of the ship. The plaintiff's estimate of its loss is $1,500,000 on the steamship, her equipment, stores, supplies, and freight, and passage money, and $500,000 on the cargo and personal effects of the master, officers, crew and passengers.

As to the responsibility, the libellant continues:

"The collision aforesaid and the damage resulting therefrom occurred without any fault or negligence on the part of the libellant or those in charge of the Republic, but were wholly due to the faults of the Florida, in that she did not keep a proper course; did not keep out of the way of the Republic, whose course she was crossing; had no sufficient lookout; did not give proper whistles or signals; did not give proper heed to the whistles or lights of the Republic; failed by her whistles to indicate her changes of helm; was proceeding at an immoderate rate of speed; did not stop her engines on first hearing the Republic's whistle; did not take seasonable steps to avoid the Republic; did not seasonably slow, stop, or back; did not port her helm, but instead starboarded her helm, thereby thwarting all efforts of the Republic to avoid her; and in other faults and neglects which will be shown on the trial hereof."

It is also asked by the White Star line that the captain of the Florida be required to tell under oath the exact position of his vessel at noon on Jan. 22; the state of the weather between that noon and the time of the collision; what soundings he had taken and what courses sailed; whether he heard the Republic's whistle before seeing her, and what orders he gave to his quartermaster or steersman between the time of hearing the first whistle and the collision.

THE MAURETANIA'S NEW PROPELLERS.

The final work to the internal overhaul of the Mauretania has been practically completed. Most of the builder's men who have been working in conjunction with the Cunard engineering staff have returned to Newcastle. Mr. Swan, of Messrs. Swan, Hunter & Wigham Richardson, is, however, still giving the work his personal attention, and it is said that when the Mauretania sails from Liverpool on Jan. 23 he will proceed with her. The main interest of engineers seems to be concentrated upon the new propellers, which have been installed in the vessel, and which are expected to produce a distinct increase in speed, and a further reduction of any vibration. The two forward propellers each has four blades of a solid type, and each one weighs 18 tons. The two aft propellers weigh 22 tons each, and have three blades. These propellers, working at full speed, will make 180 revolutions per minute. It will be remembered that last year the Mauretania made an Atlantic trip with three propellers at an average speed of 24.8 knots. The fact raised a good deal of discussion upon the distribution of her driving power, and the suggestion was freely made that there was a better concentration with only three propellers working. Other experienced engineers, however, place little reliance upon this, but believe that the fixing of four smaller blades on the forward propellers will play an important part in their relationship to the after propellers. We understand that so far as the engines are concerned, very little alteration has been made beyond the ordinary functions of overhaul. The opinion is nevertheless held by certain experienced engineers that the Mauretania will put up an unlooked for record when the better conditions of late spring come along.

SEA BRAKE FOR INDIANA.

The battleship Indiana is to make a test of a new sea brake within a few weeks. This device is designed to prevent collisions and consists of wings 13 ft. long by 6 ft. wide attached to the sides of the vessel and hinged perpendicularly. The wings are to lie flat when the vessel is making headway and when a sudden stop is desired they will open half way from the front. It is expected that this will result in an almost instantaneous checking of speed. The mechanism of the brake will be operated by pneumatic control on the firing bridge, the station of the officer of the deck.

If these wings prove successful they will make it possible to maneuver battleships in much less space that at present and will serve to prevent accidents such as that of the British battleship Camperdown, which was rammed and sunk by the Victoria during fleet evolutions in the Mediterranean. It was seen that this collision was inevitable for some moments before it occurred and it is believed that such a brake might have prevented it.

The test will be made somewhere in Delaware bay and will be witnessed by the secretary of the navy. Some of the officials of the Cunard Steamship Co. have made requests that they be allowed to view the tests in order to judge as to whether the brake would be practicable for the Cunard liners.

LIGHTSHIP FLOTILLA REACHES THE COAST.

The lightship flotilla, consisting of three new lightships and three tenders built on the Atlantic coast for service on the Pacific coast, have safely reached their destination under command of Capt. Albert Mertz. The fleet consists of the tender Manzanita and lightship Swiftsure No. 93, which will be stationed in the Straits of San Juan de Fuca; the tender Sequoia and lightship Relief No. 91, which will be stationed at San Francisco; the lightship Columbia River No. 88, which will be stationed on the Columbia bar, and the tender Kukui, which will be stationed at Honolulu.

PERSONAL.

Robert W. Hunt & Co., consulting and inspecting engineers, have engaged the services of John Carghill, who will make his headquarters at the firm's New York office, 90 West street. He will largely devote his attention to the examination and report upon railway and other corportate properties, for which his experience gained while connected with the Pennsylvania lines, British Westinghouse, Metropolitan Railway Co, of London, and other organizations, has prepared him.

Schuyler & Caddell, Red Hook, N. J., launched a covered barge for the George L. Hammond Co., of New York, Jan. 23.

STEAM SCHOONER SHNA-YAK.

The first article of this series described and illustrated the steel lumber carrying steamship Riverside. The drawings and construction photograph which we print herewith illustrate the wooden steam schooner Shna-yak built in the summer of 1907 by Hall Bros. Marine Railway & Ship Building Co. at Winslow, near Seattle, Wash. The Shna-yak is owned by George E. Billings and associates of San Francisco, and has been steadily engaged since her construction in the lumber trade of the Pacific coast, plying between Puget Sound and all southern ports. She is a good example of the modern wooden steam lumber carrier and may be taken as representative of her class.

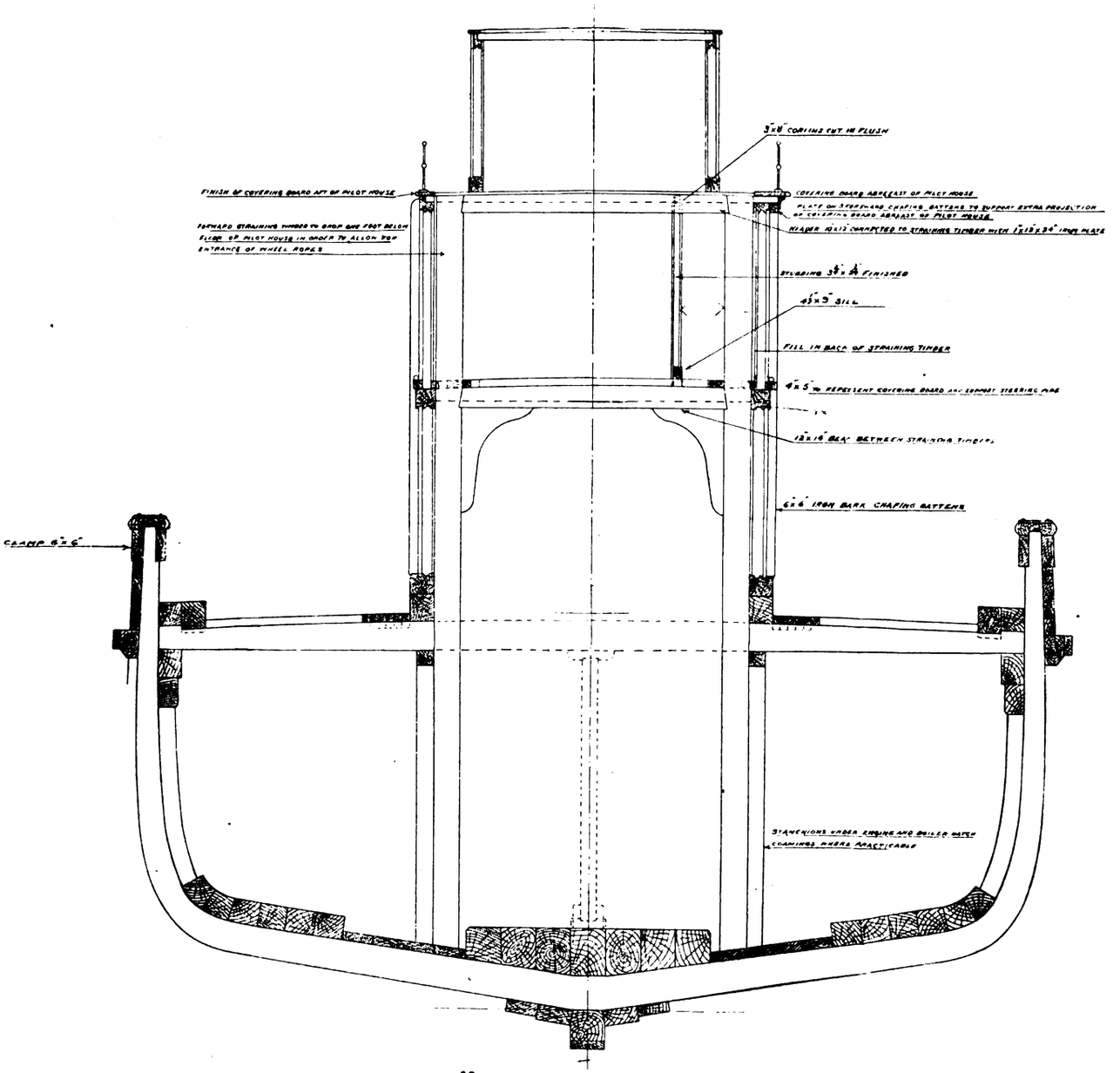
The Shna-yak is 202 ft. in length over all, 9 ft. beam and 16 ft. deep. She is built of Puget Sound fir throughout. Her frames are double 12-in. timbers spaced 32 inches center to center. There are two deck stringers running the full length of the vessel on the main deck. These timbers are spaced 13 ft., 6 in. apart and form the hatch combings and house sills. These stringers add materially to the stiffness of the hull since they are locked over the deck beams and tied firmly forward and aft.

The steamer burns crude oil in the furnaces of one Scotch marine boiler which supplies steam at 200 pounds per square inch pressure to a triple expansion engine with cylinders 13, 22 and 36 in. in diameter by 24-in. stroke. Her speed is about nine knots an hour with full load.

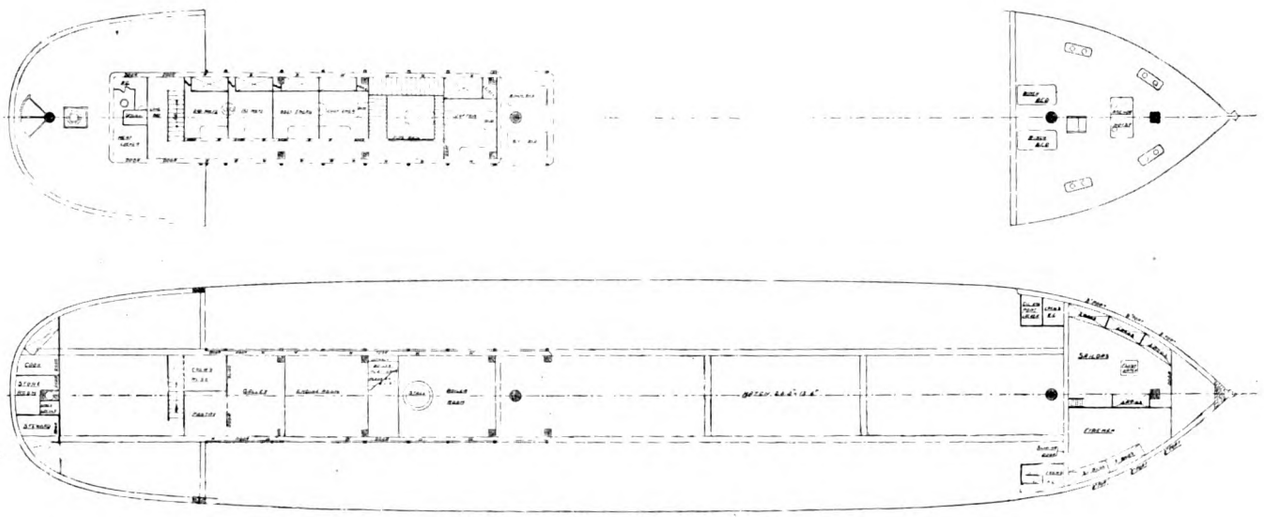
The Shna-yak has three masts of equal height, each extending 92 ft. above the main deck. The foremast and main mast each carry two 60-ft. derrick booms for handling cargo. A square sail is carried on the foremast and a leg o'mutton sail on the mizzen mast.

The cargo hold is forward of the machinery and is approximately 112 ft. long, 12 feet deep and 35 feet wide. The hold has a capacity of 600,000 board feet of lumber under the deck. In addition the steamer can carry a deck load of about 400,000 board feet. There is one cargo hatch 26 ft. long x 13 ft., 6 in. wide placed at the center of the hold.

A feature of the deck house construction is that there are a series of very heavy frames extending through the main deck to the floor of the hold.



FRAME NO. 30 STEAM SCHOONER SHNA-YAK.



DECK PLANS OF THE SHNA-YAK

These frames are tied together with beams and heavy knees at the house tops and are also tied to the fore and aft deck stringers mentioned above. This forms a support which prevents the deckload from shifting in heavy seas.

Although smaller, the general design of the Shna-yak is very similar to the of the Riverside. She has the same raised deck forward, the main deck free for cargo and the boiler, engines and cabins are all located compactly aft. Her characteristics are: Sturdy lines, relatively large cargo space, moderate power, long steaming radius and exceptionally stiff, strong, solid construction, designed to withstand heavy seas and, if necessary, severe pounding on the beach. She cost complete $125,000.

The Shna-yak represents the most modern design of wooden steam schooner. Another type that is frequently seen in the coast lumber trade has the machinery and cabins placed amidships and two cargo holds, one forward and one aft. This design has the advantage of being better balanced when light, but has not the cargo space possessed by the other type and is consequently losing favor.

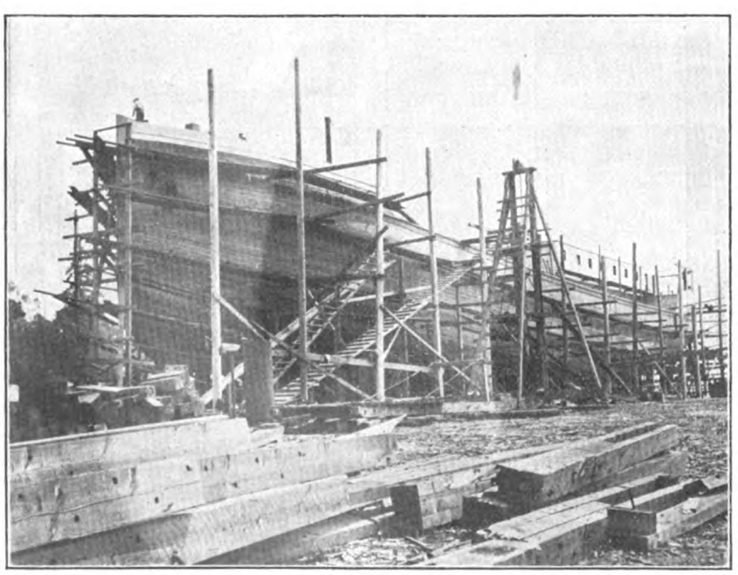
The Shna-yak carries a crew of 19 men distributed as follows: One master, two mates, three engineers, three firemen, and 10 seamen. This is two less crew than is required for the Riverside.

MAURETANIA FASTER.

The Cunard turbine liner Mauretania docked at New York Jan. 30, for the first time since the accident to her propeller last October. Since that time she has been fitted with two new propellers—on the port and starboard high pressure turbines—and these have proved a great success.

Although the Mauretania encountered a succession of gales on the passage she consumed but 5 days, 2 hours and 2 minutes, an average speed of 23.71 knots. From Daunt's rock to the Fastnet she traveled at a speed of 27 knots and at one period of the voyage she averaged 26.55 knots for five hours.

Capt. Pritchard, of the Mauretania, is confident that with fair weather she will be able to maintain an average of 26 knots for the entire passage.



STEAM SCHOONER SHNA-YAK UNDER CONSTRUCTION.

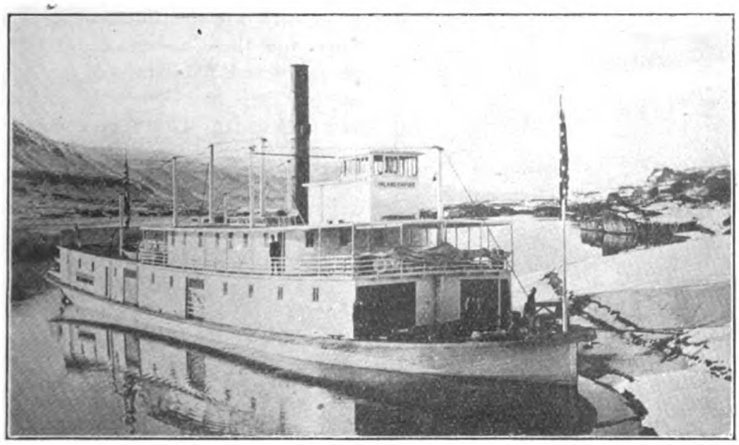
OBITUARY.

Capt. Norman Nicolson, for many years an officer and master on the vessels of the Pacific Coast Steamship Co., died at Tucson, Ariz., Jan. 24. Capt. Nicolson succumbed to tuberculosis after fighting the dread malady for several years. He is survived by his wife and two children. Capt. Nicolson was about 38 years old and was one of the most widely known seafaring men on the Pacific coast. Although a young man he has had the command of some of the Pacific Coast Co.'s best steamers, including the excursion steamer Spokane and the City of Seattle.

Walter Metcalf, of Cleveland, master diver, died at Detroit last week after an illness of many months. He was known from one end of the lakes to the other as one of the most successful divers on the lakes. He was employed in all important wrecking operations in which skillful diving was required.

Inland Empire a Typical Light Draught Western River Steamer.

For a great many years the upper Columbia river between Celilo Falls and Pasco, a distance of 140 miles, has been navigated by small river steamers. It is only recently, however, that serious attempts have been made to carry freight between these points in large quantities and in a regular manner. The new service has been inaugurated by the Open River Transportation Co., composed of a group of Portland capitalists. The officers of the company are: L. A. Lewis, president; J. N. Teal, secretary; Dorsey B. Smith, general manager; and Arthur L. Wylie, general agent, all of Portland, Ore. The company operates a fleet of five steamers, J. N. Teal, Sarah Dixon, Relief, Celilo Falls and Inland Empire. The newest and best of these is the Inland Empire, the queen of the upper river fleet. She represents one of the best types of light draught river steamers found on the Pacific coast.

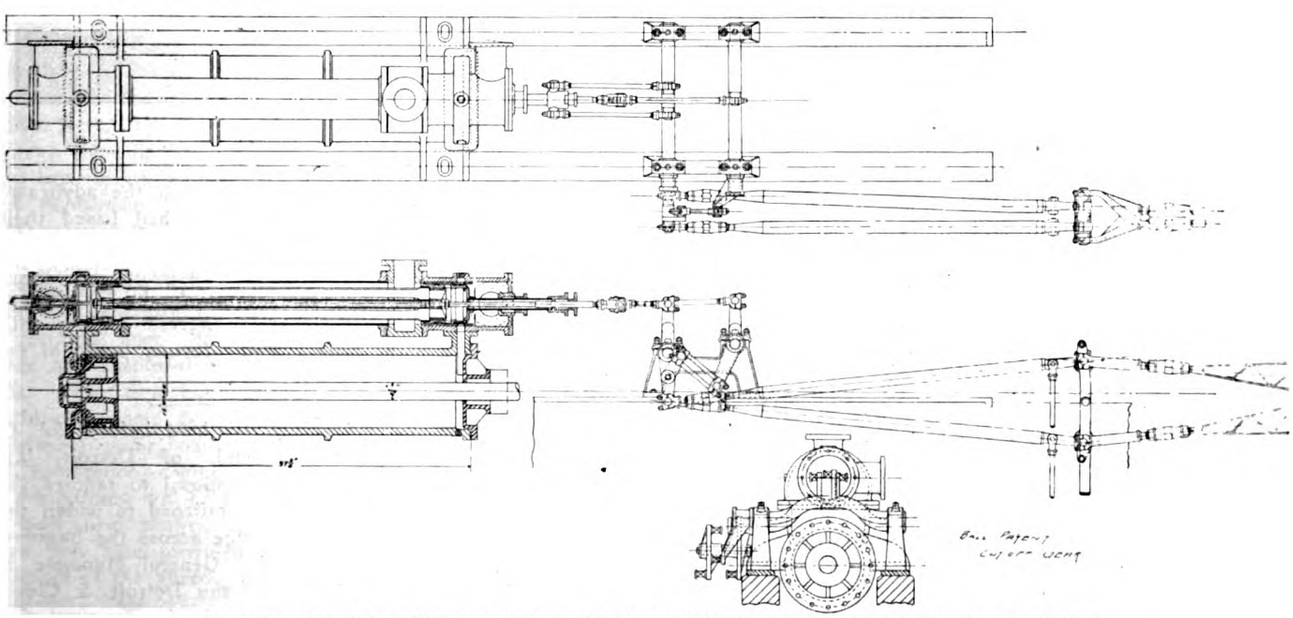


STEAMER INLAND EMPIRE OF THE OPEN RIVER TRANSPORTATION CO.'S FLEET, PORTLAND, ORE.

The Inland Empire is of the stern paddle wheel type, built of fir throughout and is light but very strong in construction. The lines of the hull are fine with a good hollow wave line forward. The hull is almost flat on the bottom with an abrupt deadrise and about three feet of freeboard. The stern is square. The under body is somewhat cut away at the stern to assist the water in reaching the wheel. The hull is braced by two trusses, one on each side, running fore and aft. There is also the usual system of tension rods and guys clearly shown in the accompanying photograph, all of which assist in taking up and properly distributing the thrust and in providing the necessary stiffness. The hull is 160 ft. long and 34 ft. beam.

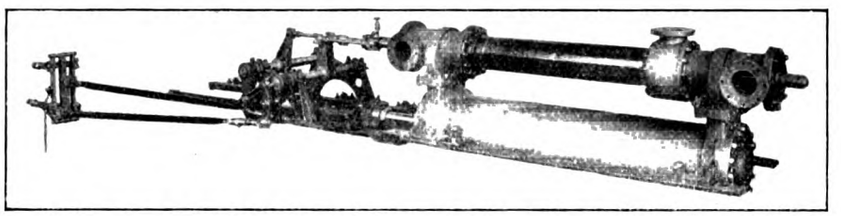
The superstructure consists of a boiler, engine and freight house on the main deck, surmounted by a passenger cabin on the passenger deck, with the pilot house and Texas on the hurricane deck above. The cabin arrangements are tasty and commodious, although the Inland Empire is not intended for a passenger steamer. There is a galley and dining room in addition to the usual accommodations.

The Inland Empire follows in most essentials what may be called the standard Pacific coast type of stern wheeler, and by reference to the illustration it will be seen that this type differs considerably from the usual styles seen on the Mississippi and Ohio rivers. The most important differences are that the eastern river boats usually have more superstructure, and also the main deck forward of the cabins is built in the east with a large overhang so that the plan of the deck is almost a rectangle. Pacific coast boats do not



CROSS SECTION OF ENGINE OF STEAMER INLAND EMPIRE SHOWING BALL PATENT CUT-OFF GEAR.
Built by Willamette Iron & Steel Works, Portland, Ore.

carry the enormous forward deck loads customary on the eastern rivers and so their decks follow the lines of the hulls more closely. Another important difference is in the location of the boilers. On the great central rivers, the boilers of most of the boats are installed on the main deck, the furnace doors being from 2 to 3 ft. above the deck. On the Pacific coast it is customary to cut away the main deck and set the boiler on specially placed



ENGINES OF STEAMER INLAND EMPIRE.

boiler keelsons, which are bolted to the frames. This design has several advantages. The center of gravity of the boilers and consequently of the whole boat is lowered, giving greater stability. Less framing to support the boilers is required and the installation is cheaper; the stress due to the weight of the boiler is communicated directly to the frames, where it is absorbed. The spaces under the main deck can be and are used for fuel bunkers to advantage, which is not possible where the furnace doors are placed from 5 to 7 ft. above the floor of the hull. On the eastern rivers it is customary to have a separate smoke stack for each boiler, or at least two stacks if there are two or more boilers. On the Pacific coast most boats are built with only one stack; in fact the rule is general to have only one boiler even for the larger boats.

The Inland Empire has a capacity of 250 tons of freight with a draught of 30 inches; her draught light is 12 inches. Her speed in still water is from 16 to 17 miles per hour.

Her boiler, which is standard, up to date design, was built by Johnston Bros., of Ferrysburg, Mich. The boiler carries a steam pressure of 225 pounds per square inch.

The engine, which we illustrate herewith by photographs and drawings, was built by the Willamette Iron & Steel Works, Portland, Ore., and has a number of original features. The valve gear is patented by Mr. Bert C. Ball, chief engineer, Willamette Iron & Steel Works.

The engine is a standard stern wheel type having two high pressure cylinders each 16 in. in diameter by 72 in. stroke. The valve chest and cylinder, as is usual in engines of this type, are cast separate. A piston valve of special form is used which carries a cut off valve inside the main valve. The valves are operated from eccentrics on the main shaft through a three bar marine link. The link carries two radius rods, one for the main valve and one for the cut off valve. The cut off radius rod drives the internal cut off valve through a special arrangement of rocker arms, which enables the engine to secure a sharp cut off at any part of the stroke. Everything about the engine is made as light as possible consistent with strength. The long eccentric rods are made of light, trussed steel.

As was noted in the MARINE REVIEW, Dec. 3, 1908, and Jan. 7, 1909, the Inland Empire was launched Nov. 21, 1908, and made her first run from Celilo to Pasco, Dec. 28. On this first trip she carried 150 tons of freight; the largest single cargo heretofore carried on the upper Columbia was 40 tons. The new steamer will run regularly on the Columbia river between Celilo Falls, Pasco and Kennewick and on the Snake river between Pasco, Wash., and Lewiston, Idaho. The Open River Transportation Co. also operates steamers on the lower river between Portland and Celilo, which, in connection with the Oregon State Portage railway forms a complete system between Portland and the inland empire territory.

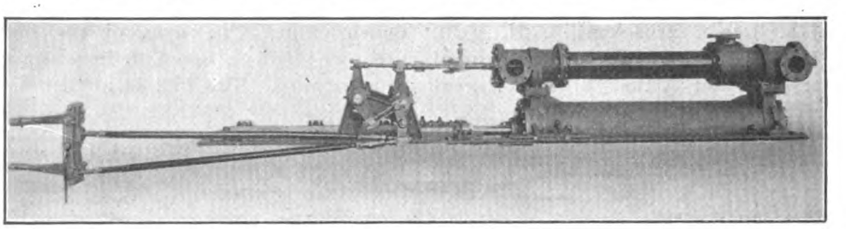
PIG IRON SITUATION.

Some rolling mills report an increase in specifications against contracts in January as compared with December, in the case of the heavier products especially. There is more general cutting in sheets the past few weeks. Three blast furnaces are now in operation at Gary, Ind., with a capacity of 13,500 tons per month each. Mahoning valley makers of basic pig iron have decided to compile the monthly average selling price of their product to be used as a basis for sliding scale contracts for various material. Heretofore the average selling price of Bessemer pig has been the standard. The pig iron market is very dull. The Pennsylvania railroad has ordered 2,200 steel cars for the lines west of Pittsburg and the Chesapeake & Ohio has also ordered 500 cars. A fair tonnage of steel rails has been ordered by western railroads. There is some cutting on steel plate prices. The coke market is possibly a little stronger, but low prices still prevail for prompt delivery.

GATUN DAM SAFE.

It has been made practically certain that the plan for a lock canal will be recommended by the board of engineers who are visiting the canal zone with President-elect Taft. The engineers have made an extended inspection of the site of the Gatun dam and the work which has been done there and it is stated that the result of the investigation proves that the dam can be constructed with entire safety.

As this was the chief problem confronting the builders of the lock canal, and the one on which the advocates of a sea-level ditch had based their strongest criticisms, it is evident that no reason will be found to change the conclusions reached by President Roosevelt and congress dealing with the report of the former board of expert engineers.



ENGINES OF STEAMER INLAND EMPIRE.

A hearing was held before Col. C. McD. Townsend, of Detroit, last week, on the proposal to require the Pere Marquette railroad to widen the draw of its bridge across the Saginaw river to 90 ft. General Manager A. A. Schantz, of the Detroit & Cleveland Navigation Co., represented that they were prohibited from entering Saginaw by the present bridge.

Yarrow's New Ship Building Yard in the Clyde.

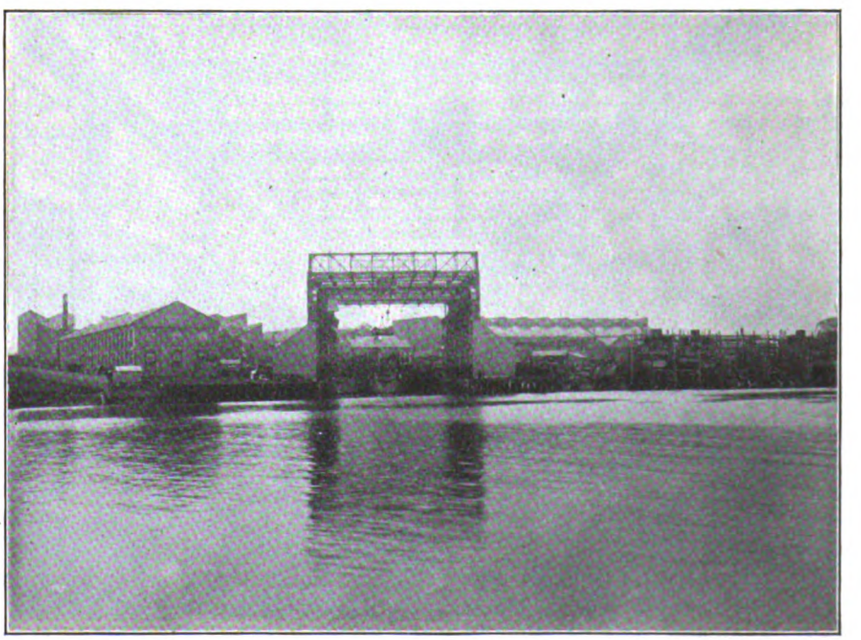
Yarrow & Co., Ltd., have now completed the transference of their extensive ship building and engineering business from the Thames to the Clyde. In order to carry on the business profitably Messrs. Yarrow were compelled to remove from London to some place where the cost of materials, transport and labor were lower, and where the burden of local taxation did not press so heavily. After a number of possible sites had been examined, the firm's choice fell upon Scotstown, near Glasgow, and in March, 1906, a start was made with the erection of the new works there. The work in the new yard in both the ship building and engineering departments, is now in full swing, and employment is found for at least 1,200 artisans, many of whom have accompanied the firm from the Thames. Messrs. Yarrow will, as hitherto, confine their energies to the construction of torpedo boat destroyers, torpedo boats, and shallow-draft steamers of all types. The firm have already earned world-wide fame for the building of high-speed motor boats, driven by internal combustion engines, and this side of the business will be further developed in their new works. Special facilities have also been provided for the construction of the Yarrow water-tube boilers.

YARROWS' NEW WORKS ON THE CLYDE—SEVEN-TON GANTRY CRANE AND PLATERS' SHED ON THE LEFT.

The new yard and workshops which cover an area of 12 acres, adjoin Scotstown West Station on the Lanarkshire & Dumbartonshire railway. On the south side of the yard there is a river frontage of 784 ft., and the site of the works extends landwards to South street, a distance of about 710 ft. To the west lies a vacant piece of land which Yarrow & Co. have the option of acquiring should they wish to extend their premises at any time. In laying out the yard special attention has been given to the arrangement of the various workshops with a view to ensure a perfect supervision from one chief administrative center. The general offices are situated in the center of the northern boundary, facing South street, the engineers' shops being on one side and the boiler shops on the other, so that the managers of these departments are within easy reach of the administrative offices.

The building to the west of the yard, the engineering department, include machine shops, general stores, tool stores, power station, smiths' shop and pattern shop. The engineering shop is 210 ft. in length by 153 ft. in breadth, and is divided into three bays. It is fitted with a 50-ton electric traveling crane on the upper of two sets of rails at a height of over 41 ft. from the ground to rail level. On the lower set of rails there is a 5-ton traveling crane. The central bay forms the heavy machine and erecting shop, while the side bays, which are served, the one by a 20-ton traveler and the other by a 5-ton traveler, form the light machine shops. To the east side of the central offices are situated the boiler shops, the platers' shed, the galvanizing shop, etc. The boiler-making shop has, of course, been specially fitted up for the construction of the Yarrow type of boiler. One of our illustrations gives an interior view of this building and of Yarrow boilers in course of being built.

Not far from this building is the platers' shed and angle-bending shop, where the steel workers prepare the



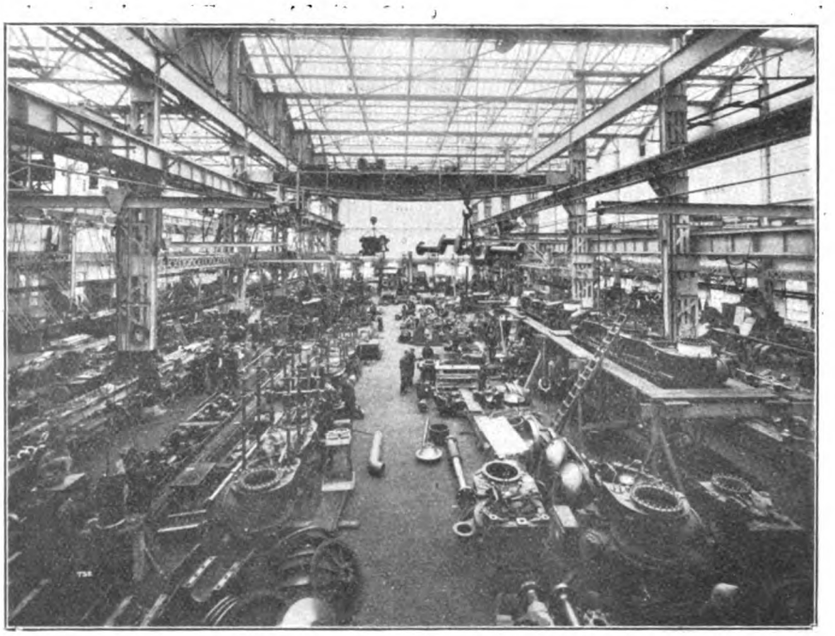
YARROWS' NEW WORKS ON THE CLYDE—GENERAL VIEW OF THE YARD.

structural material, and adjoining space is provided for the erection of light draught craft intended to be taken asunder and shipped in pieces for re-erection abroad.

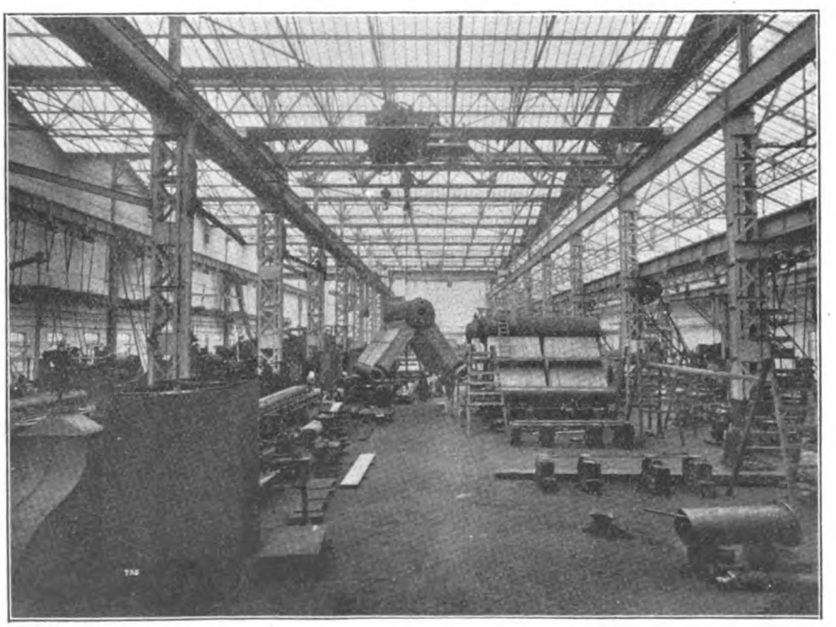
The building berths and launching slips occupy about 360 ft. of the river frontage. They are at present eight in number, and are inclined to the river at an angle of 60 degrees. Abreast of the berths the river is about 500 ft. wide, with a depth of from 20 to 24 ft. at low water of spring tides. The depth, however, will be increased by dredging by the Clyde trust.

To the westward of the building berths a wet basin has been constructed. This tidal dock, which will be used for fitting out the vessels after they are launched, is 330 ft. in length by 86 ft. wide, with a depth of 14 ft. at low water. It is set at an angle to the river so as to prevent silting up. The dock is roofed over with glass, and equipped with a 50-ton electric traveler with a span of 93 ft., commanding the whole area of the basin. It is also well equipped with all tools required in fitting out vessels. At either side are lean-to working shelters, and our illustration shows this covered dock as now completed. The patternmakers and jointers' shops extend to 270 ft. in length, by 45 ft. in breadth. The upper floor of the same building is used as a laying-off loft. Electricity for lighting and power is supplied by the Clyde Valley Electric Power Co. All motors ordered for new machinery are of the alternating current type, but the plant brought from London includes 80 direct-current motors. In order to supply current for these, a motor generator has been installed which will supply direct current at 210 volts. All the constructional work of the new establishment has been carried out by Sir William Arrol & Co., Glasgow. The workshops are fitted up with tools and appliances of the latest and most approved types from leading makers. Messrs. Yarrow's new establishment is admitted on all hands to be second to none in the kingdom, and it forms a distinct acquisition to the premier industry in the Clyde district.

The firm estimates that in their new works they can effect a saving of fully 10 per cent as compared with their old works at Poplar, on the class of vessels which they build



YARROWS' NEW WORKS ON THE CLYDE—MACHINE SHOP.



BOILER SHOP OF YARROWS' NEW WORKS ON THE CLYDE.

OBITUARY.

Lake vessel interests in general extend sympathy to Capt. George P. McKay, treasurer of the Lake Carriers' Association, over the death of his wife, which occurred on Monday, Jan. 24, at her home in Clifton Park. Mrs. McKay was one of the pioneer residents of Cleveland, having come to this city in 1853, at the age of 13 years. She was born in Taunton, Eng., April 17, 1840. She was married 50 years ago last August to Capt. McKay, the couple receiving congratulations of many friends at the golden wedding. Early in her married life Mrs. McKay embraced the Catholic faith and was extremely active during her long career in charity and religious work. She was one of the prime movers in the establishment of Charity hospital when it was projected by the late Bishop Rappe. She was a charter member of the Circle of Mercy, and for many years acted as its purchasing agent and as a member of the board of managers. She represented the Catholic interests in a few kindergarten associations. She also furnished two rooms at St. Alexis hospital. Her private charities were many.

"In the Merchant Service"

It was around 6 o'clock in the evening when Carson, one of the junior engineers of the Alroma, arrived on board to take charge for the night. Johnson, his room-mate, whom he was relieving, sprawled lazily on the settee and beyond a careless "hullo" took no notice of his arrival. His appearance, however, was not at all to Carson's liking.

"Aren't you going ashore?" asked Carson, as he threw his hat and coat on a bunk.

"Naw," growled the reclining one, "why do you ask?"

"Oh, no particular reason," said Carson hurriedly. Then he stepped to the room door and beckoned some one in the alleyway. "Bring it in here," he said in a low tone, and his room-mate sat up to take notice as a porter stepped into the room and deposited what appeared to be a large toolbox on the deck.

"I see you've got it with you," said Johnson, as the porter accepted his fee and took his departure. Carson decided that as Johnson was aboard for the night he would take him into his confidence sooner than he had intended to.

"What do you think it is?" he asked, as he produced a key from his pocket and prepared to open the box.

"Well," said Johnson, slowly, "if there are some hooks inside the top of it I would say it was a wardrobe. And then again—"

"Aw, cut it," said Carson, anxiously, "it isn't as big as all that. I hope we'll find room for it. It is—in fact—it's an organ."

His room-mate sat bolt upright and stared long and earnestly at the object of attention. Then he stepped to the floor, peered up and down the alleyway, carefully drew the curtain over the fanlight of the door and returned to his seat. "What did you say it was?" he whispered, hoarsely.

"Why," said Carson, with assumed carelessness, "it's only a collapsible organ I picked up second-hand along the water front."

"What are you going to do with it?" pursued his friend.

"Going to learn to play on it, of course," answered Carson, indignant at his mate's senseless question.

"Well, that is the limit," murmured his tormentor, "who do you suppose is going to stand for—. Well, open it up, and let's get the worst of it over."

With much exertion and considerable argument the diminutive organ was at last hoisted into shape and lifted close to the settee. Johnson seated himself on the starting platform with his feet on the blowers and carelessly ran his fingers over the time-worn keys. "There is a large percentage of slip," he said, knowingly.

"I knew that when I bought it," said Carson, anxiously watching the wild paddling of his room-mate's feet, "but we'll soon fix that with some canvas and a little glue."

They had been at work on the relic of long-gone camp meeting days a matter of a couple of hours when the second engineer hurriedly opened the now unlocked door. "Say, how do you fellows think I can write—." Then he noticed the organ. "Well, for the love of heaven!" was his comment.

Ignoring most of his numerous remarks the room-mates proceeded with the work on hand. So long as the Second didn't raise a howl about the presence of the organ in the alleyway they didn't mind his comments. Then the Second awoke to a sense of duty.

"Which of you are on watch?" he asked.

"I am, sir," said Carson, promptly.

"How are things below?" pursued the Second, scanning the go-ashore garments which still encased Carson's form.

"All right, sir, said Carson, hesitatingly, "I'll just take a run around now and have a look at things."

"HE WAS IMPATIENTLY AWAITING MY ARRIVAL."

"Do you mean to say," said the second engineer sternly, "that you relieved the watch and have not been down below; two hours ago, too?"

The owner of the organ hurriedly made his escape down the engine room, where he had a look at the donkey boiler and pump, the dynamo, sounded the bilge wells and performed a few other services. Then he returned to his room to find that the Second had withdrawn to his room and his room-mate was diligently toiling over the organ. With a few

remarks on the misplaced energy of his superior, he savagely attacked the glue pot.

Later, on thinking things over, he walked along the alleyway to make peace with the second engineer, as after all, the second might be in the right. "I've just been down below again," he said, as he opened the second's door, "and everything is all serene."

"That's good," said his superior, pleasantly, as he looked up from his writing, "so long as you take a run down once in a while there is little chance of anything serious happening."

"I was afraid at first that you were annoyed—."

"No, no, nothing of the sort," answered the second engineer, "but take a seat and I'll tell you of a little experience I had when I was about your age, and you'll perhaps see some reason for my hurried remarks."

They both filled their pipes, and when comfortably seated the second engineer commenced his story.

"In my young days," said the second, "the packet I was on had no electric light or any other up-to-date installation. I may also remark that we had no oiler—like you now have—to keep an eye on things generally. There were less engineers to a ship of her size, too, so a man had more sense of his responsibility. We had a fellow named Bryant as one of the engineers, a mighty nice fellow to sail with. Nothing was too much trouble when any favors were needed of Bryant, and he was always hungry for particularly hard, hot or dirty work aboardship.

"Bryant had one failing, however, and it always showed up when the ship was in port. He looked on port watches as an imposition. He never failed to yelp on seeing the watch list and would, if at all possible, get out of doing some of the night watches. In the usual order of succession I was the man to relieve Bryant, and I always found him ready to depart as soon as I put foot on the deck. In fact I made a point of relieving him an hour or so earlier than I had to, and Bryant got in the habit of expecting me so much sooner.

"One evening I was a little later than usual through being held up in a car accident, but arrived to relieve Bryant just on time. He was impatiently waiting my arrival, pacing back and forth on the deck in his shore clothes and uniform cap. 'What the devil has kept you, Joe?' he yelled, as he sighted me, 'I have been waiting a solid hour for you!' Now, as I was still in time I felt rather indignant, and didn't hesitate to let him know that his remark was altogether uncalled for. He threw on his coat and hat, cussing all the time, and skipped for the shore without even saying good night."

"He was an ungrateful cuss, all right," said Carson, indignantly.

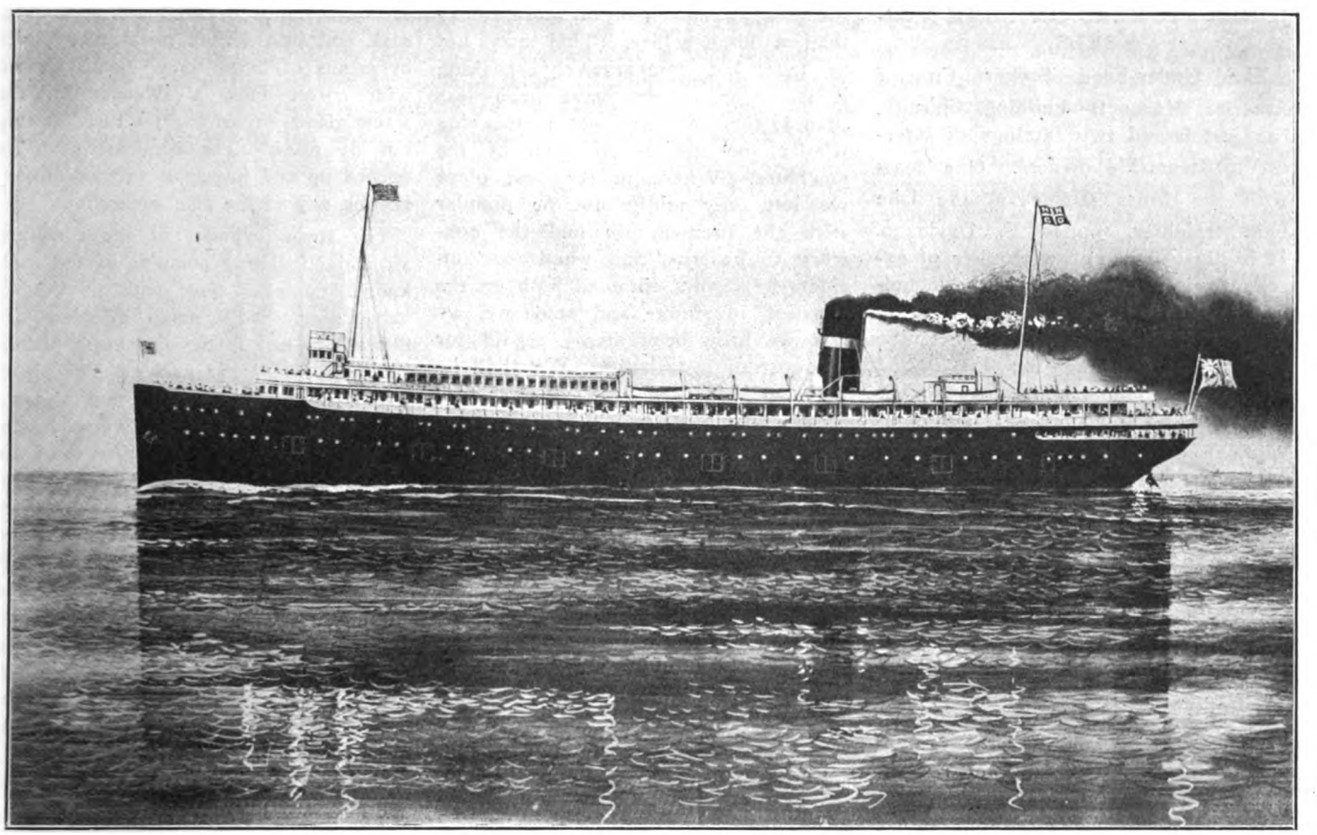
"Well," continued the second, "I hung around the deck until it became too dark to see the sights, then went into my room and lit my oil lamp. You know how a fellow feels when he is about the only person on a ship, when the cargo winches are all shut down and everything is deadly still. The lamp hadn't much oil in it and was burning pretty low, just enough to let you know how dismal things were. I had been aboard about a couple of hours, but couldn't help thinking that the least Bryant could have done was to see that some oil was in our room lamp for my benefit.

"We kept the oil in tanks on the main platform back of the engines, and the only way I could trim my lamp was by taking it down below. Seeing there was no help for it I put on an old coat and started down the ladder. Usually we shouted on the donkeyman to come into the engine room and show a light, but as I had my lamp along I dispensed with that ceremony. On reaching what looked to me like the last step on the ladder I stepped off—into about 18 inches of water.

"I WAS JUST IN TIME TO SEE THE 'SUPER' EMERGE FROM THE STORE."

"Gee whiz!" exclaimed Carson.

"I didn't even take time to say gee whiz," said the second, "but shouted on the donkeyman to bring a lamp. As his pump was in the boiler room he hadn't found it necessary to step into the engine room, so hadn't seen the water. The ship had quite a list to starboard



THE NORTHERN NAVIGATION CO.'S NEW STEAMER HAMONIC AS SHE WILL APPEAR WHEN COMPLETED.
Building by the Collingwood Ship Building Co., Collingwood, Ont.

and the water was all gathered on that side. Well, it didn't take me a couple of minutes to get the bilge pump under way and see that she was drawing clear. I also started the auxiliary pump, grovelling in the water for the proper valves.

"After a while the water commenced to creep down to the level of the foot plates and was soon out of sight, though the bilges were still flooded. The ship commenced to straighten up a bit, too, as the water went over the side. I had found by this time that it was fresh water I was pumping, and got the foot plates lifted to search for its source. It turned out that the filling pipe from the shore had rotted away at one place, leaving a hole you could easily stick your thumb into. This I clipped with a strip of muntz metal and rubber and the job was finished."

"That was what you might call a narrow squeak," said Carson, as the second officer re-lit his pipe.

"That is not all," continued the second, "as, just when the bilge pipes were shut down I had another scare. On going on deck to get a breath of cool air I looked out over the side toward the dock. I was just in time to see the 'super' emerge from the store and walk toward the ship. I had still my shore-going pants and shirt on and they were in a sorry mess, so skipped to my room and was just in time to get into a dirty boiler suit. When I met the 'super' on deck he remarked that I looked as if I had been working."

"What did you tell him?" asked Carson.

"Oh, I merely told him," answered the second, "that I had been under the plates tracing a pipe."

"Which was certainly true enough," said Carson, as he arose from his seat and prepared to leave the room. He could hear Johnson having a preliminary turn out of the organ.

"Say, Carson," called the second atfer the retreating figure of his subordinate, "do you know where the indicators are kept?"

"Certainly, sir," said Carson, inwardly praying that no little job had been found to keep him from joining Johnson.

"Well, just take a couple of cards off that blessed box of heavenly music, will you?"

THE "STAND-BY" MAN.

A RECORD BRITISH DREADNOUGHT.

The first keel plate was laid at Portsmouth on Jan. 19 of the battleship Neptune, which is to be a record Dreadnought. She will have a displacement of 20,200 tons, and a length of 510 ft., or 20 ft. more than the original Dreadnought. Her ten 12-inch guns, mounted in pairs in barbettes, will have a superior range. The vessel, which will cost $10,000,000, is to be completed in two years.

As in all vessels of the Dreadnought class, turbine engines will be fitted with 25,000-horsepower in the case of the Neptune, giving her a speed slightly in excess of the other Dreadnoughts. An important improvement in the new ship is the arrangement of the ten 12-inch guns, which will form her armament. The former Dreadnoughts have a stern fire of only six guns, but the after turrets of the Neptune will be so placed that the inner guns will fire over the top of the extreme after turret, giving a stern fire of eight guns. With the commencement of the Neptune the British navy has built or building 11 ships embodying the all-big gun principle introduced in the Dreadnought, and ten of the immediately preceding types, with a heavy mixed armament of 12-in. and 9.2-in. guns.

JONES STOKERS ON LAKE VESSELS.

The Under-Feed Stoker Co. of America, Marquette building, Chicago, has just issued two catalogs of interest to steamship owners. One deals with the Jones stoker on the lake bulk freighter, James E. Davidson. It is illustrated with a number of excellent views of the steamer, including a view of the firehold showing six Jones stokers under her Niclausse boilers. Concerning the installation Mr G. A. Tomlinson, owner of the Davidson, has written to the company as follows:

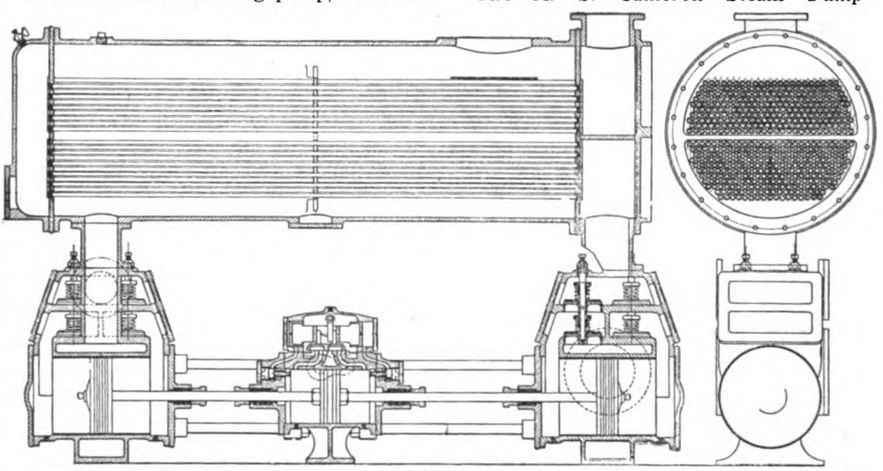
"I am very much gratified to advise you that the stokers installed on the steamer James E. Davidson, which have been in operation since June 18. 1908, have fully fulfilled all the representations you made with respect to efficiency and economy. The steamer Davidson has Niclausse boilers. A different method of firing the boilers was used each of the three seasons before the Jones stokers were installed this season, and in each instance the operation of the ship was not reliable, the fuel consumption per trip was about 400 tons of slack coal. The fuel consumption with the Jones stoker is about 300 tons of slack coal for the round trip. Two of the firemen who shipped when the vessel began operation in June remained aboard until the vessel was laid up."

The other catalog deals with the Jones stoker on the hydraulic dredge Francis T. Simmons, engaged in work by the Lincoln Park board of commissioners, Chicago. Concerning the efficiency of these stokers, Francis T. Simmons, president of the board of commissioners, writes:

"Regarding the efficiency of the dredge Francis T. Simmons, which is the property of the commissioners of Lincoln Park, I am glad to say that it has been enhanced very much by the installation of the Underfeed stokers. We suffered all the ills of bad smoke until on the 15th day of April, 1908, your stokers were installed, and have been running 24 hours a day ever since. Our primary reason for installing them was that of abaiting the smoke, but we find that the economy resulting has been on its part even greater. Last year we used coal costing $3.75 per ton and fired by hand. This year the stokers have used $2.35 coal and the efficiency of the boilers has been up to the requirements constantly and at all times. We have often stated that the great dredge made no more smoke than a kitchen fire. This may not be true, but comparatively speaking it is. Our repairs have been less than $5 for the entire season, speaking wholly for the construction of the machines. Where in the first place we felt they might not be popular with the firemen, we find the contrary to be true, and when we consider the results obtained both on the question of smoke and economy, we feel we have been amply repaid for the cost of installation. We shall be very glad at any time to offer you the opportunity of showing the stokers to any one inclined to examine them."

SURFACE CONDENSER MOUNTED OVER COMBINED AIR AND CIRCULATING PUMP.

The accompanying drawing is a sectional view of an independent surface condensing apparatus now being manufactured by the A. S. Cameron Steam Pump Works, New York. The condenser is shown mounted over a direct-acting combined air and circulating pump, the three cylinders of which are arranged in line, the steam cylinder being in the center and the steam and the air and water cylinders at each end. The water chamber of the condenser rests directly on top of the water cylinder and the circulating water passes upward from the water cylinder, through the lower bank of tubes and returns through the upper bank of the discharge at the highest point of the water chamber. Exhaust steam entering the top of the condenser near the circulating water outlet spreads along the entire length of the condenser before passing on its course down through the tubes where it is condensed.



SECTIONAL VIEW OF CAMERON CONDENSER MOUNTED ON COMBINED CIRCULATING AND AIR PUMPS.

The condenser shell, water chamber, and covers are of cast iron. The tubes are of seamless drawn brass, secured at each end into Muntz metal tube plates by means of brass screw glands packed with corset face, a shoulder on the screw glands preventing the tubes getting out of place. The condenser can be opened up and inspected without disconnecting any of the pipe connections.

The steam cylinder of the combined air and circulating pump is of the well-known Cameron type, with no outside valve gear. Both pump cylinders are brass-lined and fitted with brass pistons arranged for fibrous packing. The piston rods are of Tobin bronze and separate at the steam piston. The valve system in both air and water cylinders is of the usual Cameron arrangement and is easily inspected on removing the cylinder covers. Each valve stem holds two valves with their springs one above the other, so that by unscrewing one plug and pulling out the stem both are released. Where there is not sufficient head room the condenser may be placed alongside the pump, but in all cases must be high enough for the condensed water to flow by gravity to the air pump.

The A. S. Cameron Steam Pump Works are prepared to build all sizes of surface condensers up to 1,500 H. P., and can furnish condenser shells of sheet steel or copper where lightness is a factor, or pump ends of all brass, if desired.

A. P. Kenyon, of Marine City, Mich., has done quite an extensive business in repairs and rebuilding wooden vessels during the past year, aggregating $60,000. For labor he expended the sum of $26,000 and there was a pay day for each week of the entire year. Mr. Kenyon expects to do a good business in rebuilding and repairs during the winter and spring.

A NEW LINE OF AIR COMPRESSORS.

The accompanying illustrations show features of a new line of air compressors which have recently been placed on the market by the Thos. H. Dallet Co., Philadelphia. These compressors have developed several new ideas in compressor design. All parts requiring adjustment or renewals are readily accessible and a liberal amount of metal has been used where needed to insure rigidity in operation.

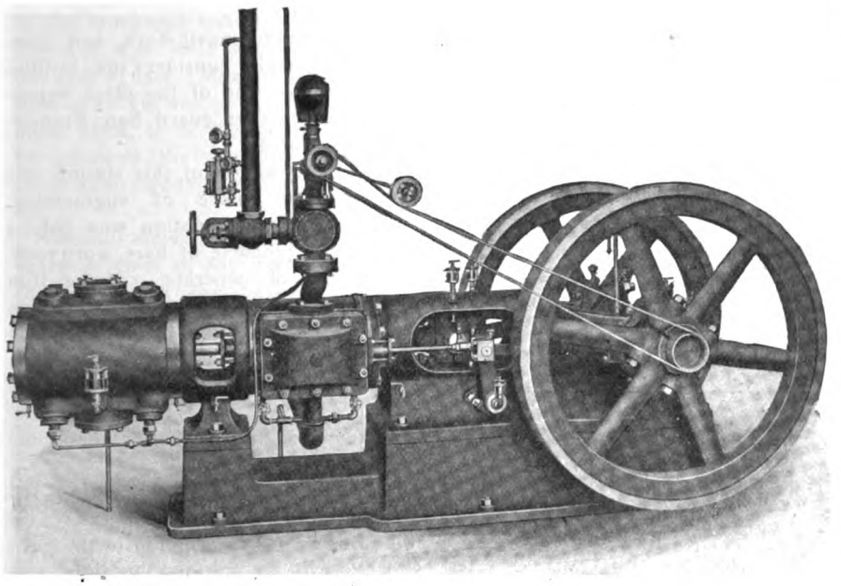


FIG. 1—SINGLE STEAM-DRIVEN COMPRESSOR.

The frame is of the open fork center crank type, and is of massive design to permit on each size of compressor, when desired, a greater range of capacity by substituting a cylinder of the next larger size than the standard to operate at 100 pounds pressure. Thus, a 10-inch cylinder may be placed on an 8-inch compressor frame, giving somewhat increased capacity at slightly greater first cost. The line of compressors designed comprise both steam and belt-driven machines of the straight line and duplex types. In the case of duplex compressors with compound steam cylinders, a reducing valve has been inserted between the high pressure steam pipe and the low pressure cylinder, enabling live steam to be fed to the low pressure cylinder for starting purposes, when the high pressure cylinder has stopped on a dead center.

Air and steam cylinders are tied together and held in position, by means of an internally flanged distance piece. On the smaller sizes, this piece supports the air cylinder, but on the larger sizes, the air cylinder is supported on a pedestal, while the tie piece is of circular section without the foot piece. Ample openings are provided to permit adjustment of the stuffing boxes and tightening of the cylinder stud nuts. In the air cylinders, clearance space is reduced to a minimum, and all heads and cylinder walls are water jacketed. Means are provided for draining the cylinder and cylinder head jackets, an essential in cold weather. Lubrication is effected by feeding oil into the intake passage, whence it is carried by the suction into the cylinder in the form of a spray. Mechanically-operated inlet valves are supplied on all sizes of compressors, when desired. The valves are ground to gage, and the valve holes lapped to size. These compressors are suitable for vacuum service, and are furnished with mechanically-operated inlet valves for high vacuum.

The intake valve is of the automatic poppet type, and is contained in a malleable iron cage, which is in one piece and combines both the seat for the valve and the guide for the valve stem. The cage is threaded and screws into the wall of the air intake chamber only. It seats in a recess of the main cylinder wall, and has thin corrugated copper gaskets to secure a tight joint. The valve cage cap acts as a lock nut for holding the cage in place after it has been screwed down to its seat in the cylinder. In the case of a compound machine, corrugated copper gaskets are placed under the valve cage caps on the high pressure cylinder to insure against any leakage. The valve proper is a hardened special alloy steel, with seat and stem ground to gage. The spring holder comprises a split taper ring set into a recess on the valve stem and held together and tight to the stem by means of a solid taper ring slipping down over it. The hammering of the valve on its seat tends to tighten the spring holder on the stem instead of driving it off. This eliminates any tendency of the spring holder to shear off or work loose from the stem. The discharge valve is of the automatic poppet type, and is contained in a valve cage of malleable iron. The method of seating in its cylinder and locking to its seat is identical with that of the intake valve.

The inter-cooler is of large cooling area, and employs the return flow type

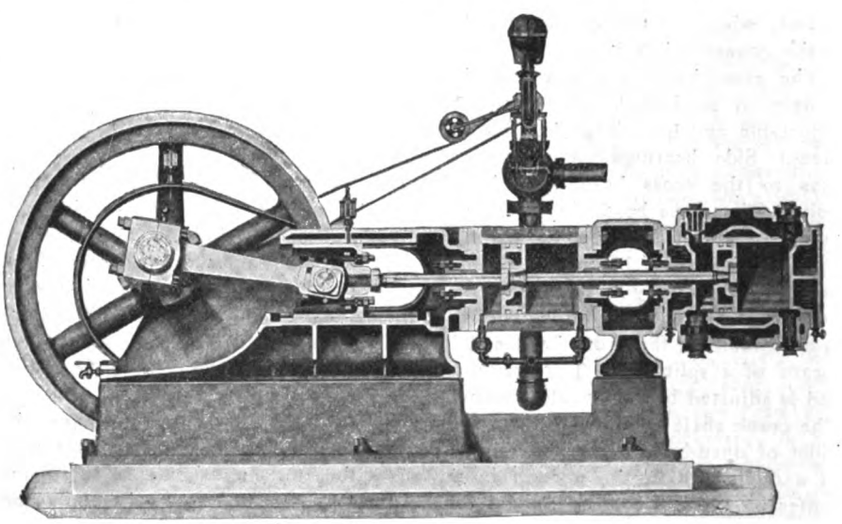


FIG. 2—SECTIONAL ELEVATION OF SINGLE STEAM COMPRESSOR.

of water circulation. Baffle plates are used to deflect the flow of air and aid in its effectual contact with the cooling tubes. This method reduces the air temperature between stages to approximately the original temperature and tends to reduce the final or discharge temperature and also the horsepower required for a given capacity. The nest of cooling tubes may be removed intact from the inter-cooler box without disturbing any of the piping. The inter-cooler is supplied with a pop safety valve, pressure gage and drain valve.

The belt-driven machines are provided with an unloading device, which automatically unloads the air cylinder. When a predetermined pressure is reached in the receiver, one or more inlet valves at both ends of the cylinder are held open and the load is taken off of the compressor, allowing it to run light until the pressure drops in the receiver, upon which the valves are released and compression resumed. On the steam machines, a combined speed and pressure governor is used, which unloads the air exactly the same as on a belt-driven machine, and, at the same time, controls the speed, allowing a single steam machine to just turn over when unloaded and bringing a duplex or compound machine to a dead stop.

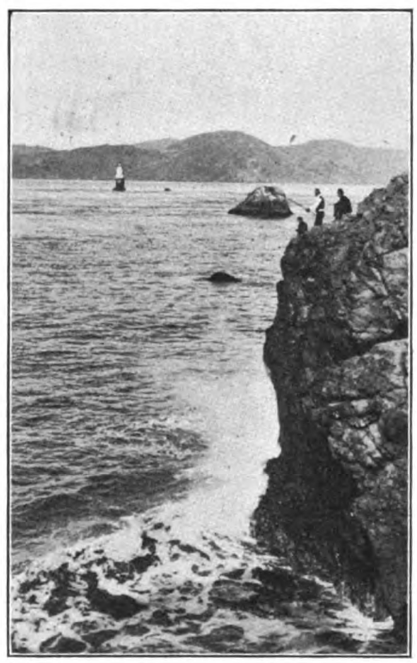
The steam cylinder and valve gear of the steam-driven machines give a high efficiency with slight attention. A plain balanced D slide valve is used on the small and medium sized machines, while a Meyer balanced adjustable cut-off valve is employed on the larger machines. The steam cylinders are lagged with mineral wool. On all steam-driven machines the governor is equipped with a safety stop device, which will stop the machine, if the governor belt breaks.

The cross head is a new type box pattern of semi-steel. The shoes are adjustable and have large bearing surfaces. Side bearings allow easy access to the cross head shoe binder bolts. The cross head pin is fitted to tapered seats in the cross head, drawn tight on the tapers by means of a nut held in position by a pin. The connecting rod is of the marine type, and is adjustable at the cross head end by means of a split box. The crank pin end is adjusted by removable tin liners. The crank shaft is forged from a solid billet of open-hearth steel, and in case of a duplex shaft, the portion in the center is enlarged to accommodate the heavy flywheel.

The compressors are built in sizes ranging from 8-inch stroke up to and including 16-inch stroke, and give a range of capacity of 79 cubic feet of free air per minute up to 1,200 cubic feet.

THE "MILE ROCK" LIGHT STATION.

The comparatively new lighthouse station which guards the southern entrance to the great harbor of San Francisco, though really only a third-order light, is one of the most important of the number that protect the port of the Golden City. This station is located a short distance west of the famous Golden Gate line and three-eighths of a mile north from "Land's End" on the southern shore. Directly north of "Mile Rock" station—



MILE ROCK LIGHT STATION.

about three miles distant—is located the first order light station on North Head. The light displayed by the latter is a clear, steady white, while that on "Mile Rock" is a steady, brilliant red. These two lights beacon the entire western, southern and northern sweep of the ocean for a radius of more than 12 miles—beyond the light ship "San Francisco No. 76," which lies anchored eight miles off (west) of the entrance to the bay.

These two light stations are the only sentinels which guard and protect the entire and immense commerce of San Francisco, both inbound and outward bound.

For a distance of more than three miles the southern coast line of the entrance is thickly strewn with sharp, ragged rocks, many of which are entirel hidden during high tide. This is a very dangerous and treacherous stretch, and the principal purpose of the "Mile Rock" station is to warn all vessels, bound in and out, against these perils.

All mariners, navigators, and masters of vessels consider the faithful little pharos one of the most important beacons that guard San Francisco's commerce.

The construction of this station was a wonderful piece of engineering. Originally the foundation was only a very sharp pinnacle of bare, worn rock. By means of concrete, a huge iron cylinder, and steel structural frame work, the foundation has been massively anchored to the immovable rock. From the mean ocean level the steel tower rises 100 ft. The light is visible for a distance of more than nine miles.

Owing to the great engineering difficulties, as well as the dangers, more than one year was required in the construction of the station. The light was first displayed early in December, 1905. At the time of the great earthquake it was feared the whole tower would topple over into the sea, but it stood as firmly as the rock of Gibraltar. In November, 1906, San Francisco experienced the most terrific gale ever known in all the history of the port. This wind storm lasted over 12 hours, attaining a velocity at times of more than 80 miles per hour. To all this fearful sweep of the gale, the little station was fully exposed, but it withstood the fury of the blast without the least indication of yielding. The total cost of the station was $100,000.

The grand lodge meeting of the Licensed Tugmen's Protective Association will be held at Toledo Jan. 19. E. F. Kemmet and Michael McDonough will represent the Cleveland lodge. The following were elected officers by the Cleveland lodge: E. F. Kemmet, vice president; Fred Carroll, corresponding secretary; Willis Brown, financial secretary and treasurer; Joseph Normand, trustee; J. C. Ryan, chaplain.

Bruce & Co., Seattle, Wash., have been awarded contract for the construction of a 500-yd. hopper deck barge for Seattle owners, to be 115 ft. long, 36 ft. beam and 12 ft. deep. She is designed by S. M. Gage, who has been very successful with similar craft on the Sound.

NAVAL EFFICIENCY DEFENDED.

In the *North American Review* for January, Engineer-in-Chief G. W. Melville, U. S. N., retired, has a contribution on the subject, "Is Our Naval Administration Efficient?" in which he both answers the question and replies to the numerous critics of naval management who have been so much to the fore of late. More directly the article is an answer to that of Rear Admiral Luce, U. S. N., retired, in which he attacked the bureau system and naval affairs generally as now conducted.

Admiral Melville believes that his 16 years as chief of the bureau of steam engineering of the navy department qualify him sufficiently to reply to some of these criticisms.

A significant statement of this characteristic article is the one made early in the argument concerning a fact that seems to have been passed over by the critics—namely, that the navy is under the constant supervision of congress and more especially by the naval committees of both its branches. Of the naval committee the author says: "Some members of it were legislating for the navy at a time when some of the loudest critics were still schoolboys. The country and the navy are indeed fortunate in the present chairmen of the two committees, Senator Hale and Representative Foss. Not only have they spent years in this work, but they have made independent studies of naval affairs, so that it is safe to say that they are among the foremost experts in naval matters in the world. It is very important to have in mind the function of these committees in their constant supervision of naval matters. The members have a pride even greater than that of the average citizen in the navy, because they can really make or unmake it. This means that important events in the navy do not occur by chance, and above all, that naval administration has not come to its present condition without the knowledge of congress."

The development of the modern battleship is shown by Admiral Melville to have been merely a process of evolution, each phase of which had been carefully looked into. The opinion of the naval experts of the world is shown to coincide with that of the Newport conference, which has decided that our navy is of the highest class in material. Now the great cruise of the battleship fleet has proved the quality of our naval personnel to be of a most superior sort and the Civil and Spanish wars are testimonials as to the fighting efficiency of our ships and men. In view of these admitted qualifications, the author asks what other evidence as to the wisdom of the present system could reasonably be demanded.

Taking the article of Admiral Luce to assume that the policy of the navy department is settled by a majority vote of the eight bureau chiefs, Admiral Melville says that not once in his 16 years as chief of the bureau of steam engineering were the eight chiefs called together as a body to settle anything.

The attempt in this same article to make it appear that "non-combatant admirals regard questions of naval efficiency from the non-military point of view," is considered by Admiral Melville as an "unwarranted depreciation of brother officers." He calls it absurd to contend that a man who is not actually shooting a gun has no interest in the outcome of the fight, and calls "comical" the attempt to ascribe to these "non-combatant, non-military admirals" such tremendous influence with congress as to be able to override the president and the secretary of war, in view of the fact that these same admirals had not sufficient influence with congress to induce it to give them titles which would correctly indicate their grade in the naval organization. Admiral Melville believes that all staff officers will agree that the most influential naval officer is the chief of the bureau of navigation, who comes most closely in touch with the secretary. As an instance of his great power, the author quotes the controversy of last year over the command of a hospital ship. The chief of the bureau of navigation resigned rather than to obey the president's order. He says, "It was a rather curious commentary on naval discipline that the officer, who under the secretary, is specially charged with the maintenance of discipline, should himself refuse to obey the order of the commander-in-chief."

That the movement for a change in naval administration has not failed because of the opposition of the bureau chiefs is argued by Admiral Melville, as he believes it to be only because its authors have been unable to persuade the naval committees that the change is advisable. As to this inability to persuade, he thinks it one of the limitations induced by long-continued autocratic command, saying that conciliation and exposition are not among the traits of character developed by a term of always having one's own way.

Admiral Melville thinks that the present criticisms are focussed upon one point in the main—that the line of the navy shall absolutely dominate the service in every particular. The influence of the chief of the bureau of navigation is at present so great that no reasonable project which he might submit to the secretary of the navy would ever be rejected and the author argues that this power makes the proposed change unnecessary.

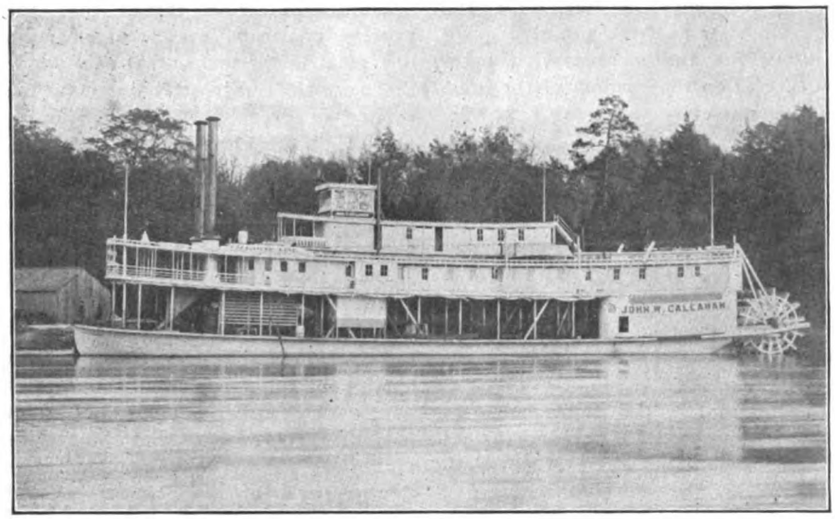
As to the preparations for a campaign being sufficient cause for a change of administration, the former bureau chief states that the bureau of navigation now has those functions within its purview and its chief, with the approval of the secretary, could exercise all the functions of a general staff with the exception of control over the remaining bureaus.

Admiral Melville states that throughout his experience he has found the staff officers favorable to harmony and now that they are called "non-combatants and non-military," he thinks that the blame for these years of ill-feeling can readily be placed where it belongs. "The general public has no idea of the indignities which have been inflicted time and again upon the staff officers of the navy by some of those who would restrict to themselves the term of 'military' officers. It is this constant spirit of arrogance and domination by a relatively few very aggressive men that causes the lack of harmony."

Admiral Melville makes it plain that he does not wish to oppose any demand by the line officers of the navy for the modification, to any reasonable extent, of existing methods to render more efficient their part of naval administration.

The Skinner Ship Building & Dry Dock Co., Baltimore, Md., was the successful bidder for making repairs to the New York & Baltimore Transportation Co.'s steamer Mana-Hata, which lost her rudder while bound from Baltimore to New York last month. The Skinner company's bid was $3,600, work to be completed in eight days.

The Kelly-Spencer Co., Bath, Me., expects to begin work soon on a schooner for stock in order to give employment to its workmen. A fine tug is at present under construction for the Commercial Towboat Co., of Boston, the machinery for which is being built by the Bath Iron Works, Bath, Me.



RIVER STEAMER JOHN W. CALLAHAN FITTED WITH GILLETT & EATON'S PADDLE-WHEEL ENGINES.

GILLETT & EATON.

Gillett & Eaton, of Lake City, Minn., have done an extensive business during 1908 in installing their type of engine in stern wheel steamers. Among the installations furnished by this company last year were: One of 150 H. P. for the stern wheel steamer Sentinel, owned by N. Fay, Sacramento, Cal.; one of 600 H. P. for the steamer John W. Callahan, owned by the Callahan line, of Bainbridge, Ga.; one of 150 H. P. for the steamer Dresser, owned by the Dresser Sand Co., Leavenworth, Kans.; one of 60 H. P. for the steamer Shoshone, owned by Carscallen Bros., Coeur d'Alene, Idaho; one of 900 H. P. for the steamer Okanogan, owned by the Columbia & Okanogan Steamboat Co., of Wenatchee, Wash.; one of 175 H. P. for the steamer Oriole, owned by the Mississippi Trans. Co., of Aitkin, Minn.; one of 100 H. P. for the steamer Sampson, owned by the Brown-Burt Logging Co., of Minneapolis, Minn.; one of 350 H. P. for the steamer Terrebonne, owned by the Bradford Transp. Co., New Orleans, La.; one of 125 H. P. for the government steamer Chippewa, stationed on Red Lake, Minn.; one of 325 H. P. for the steamer C. M. Johnston, owned by C. M. Johnston, of Helena, Ark.; one of 325 H. P. for a steamer owned by A. G. Wineman & Sons, Greenville, Miss.

SWAIN'S MARINE ENGINE WORKS.

D. M. Swain's Marine Engine Works at Stillwater, Minn., which furnishes full equipments for stern and side wheel river steamboats, has during the year 1908 furnished a number of installations of these types, including the following:

One set cross compound engines, 7 and 14 in. cylinder diameters by 42-in. stroke, non-condensing, for Rainy River Navigation Co., Rat Portage, Ont.; complete outfit for stern wheel boat for Mettaline Navigation Co., Pen d'Oreille, Idaho, consisting of high pressure engines 10 in. cylinder diameter by 60-in. stroke, hydraulic steering gear, one locomotive boiler with a working pressure of 200 pounds, capstan and boiler feed pump; complete outfit for stern wheel boat for the Northland Pine Co., Walker, Minn., consisting of engines 12 in. by 72 in., one firebox boiler, bow capstan, boiler feed pump and duplex fire pump; one set tandem compound condensing engines for stern wheeler H. M. Carter, cylinders 10 and 20 in. in diameter by 6-ft. stroke, duplex jet condenser—this was the sixth contract with the Carter Packet Co. in eight years; one complete outfit for stern wheel river boat building for Adams River Lumber Co., Shuswap, B. C., engines 12 in. by 72 in., one locomotive type boiler, with working pressure of 180 pounds, boiler feed pump, Duplex fire pump.

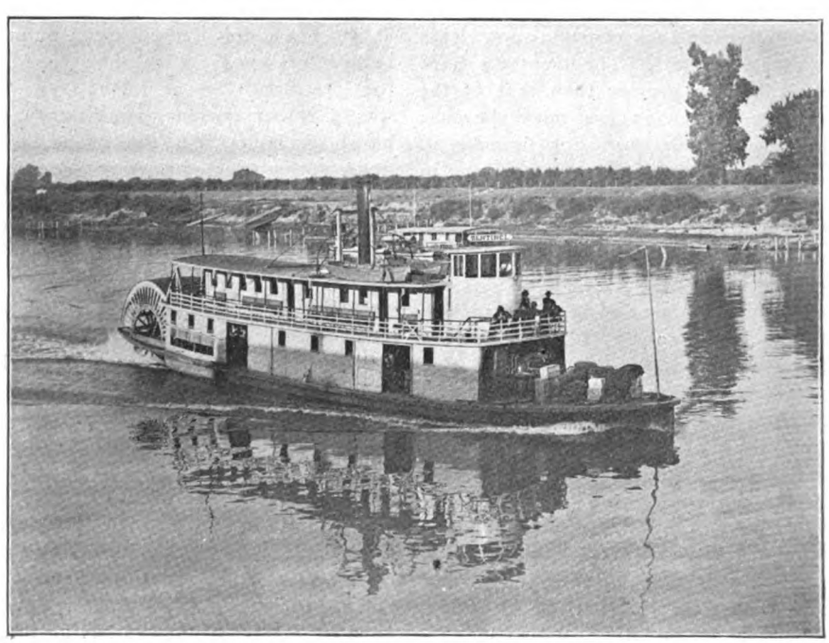
This company has experienced quite a demand for its capstans for installation on coast vessels and has also furnished a number of its boiler feed pumps to Pacific coast owners.

The LaSalle & Peoria Packet Co., of Peoria, Ill., is controlled by D. M. Swain and his sons, and they are contemplating the construction of a new excursion steamer for their Illinois river service the coming season. She is to carry 2,000 people and will be a side wheeler fitted with triple expansion engines.

SHIP YARD NOTES.

The Valk & Murdoch Iron Works, Charleston, S. C., has during the past year built four vertical marine boilers, one Scotch marine boiler and one leg low type marine boiler. This company also has an extensive business in the building of stationary boilers.

The Cuyahoga Boiler Co., Cleveland, O., has built two marine boilers during the year 1908, to replace old boilers aboard the lake tugs Rowena and Ciscoe. That for the tug Rowena is



RIVER STEAMER SENTINEL FITTED WITH GILLETT & EATON'S PADDLE-WHEEL ENGINES.

QUICK MARINE REPAIRS

The Thermit Process Enables Permanent Repairs to be Made in as Short a Time as Required for a Temporary Patch.

BY THIS PROCESS, steel sections of any size may be welded IN PLACE. All appliances are light and portable and may be *brought to the job.* Stern-posts, rudder-posts and stern frames of steamships may be quickly repaired without dismantling the vessel, THUS KEEPING THE VESSEL IN DRY DOCK ONLY A FEW DAYS AND SAVING HUNDREDS OF DOLLARS IN THE EXPENSE OF THE REPAIR. In the same way important repairs may be made to crank shafts, gear wheels and other broken steel sections.

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of the
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High efficiency because the scientific and practical requirements for the rapid absorption of heat are fully embodied in our construction.

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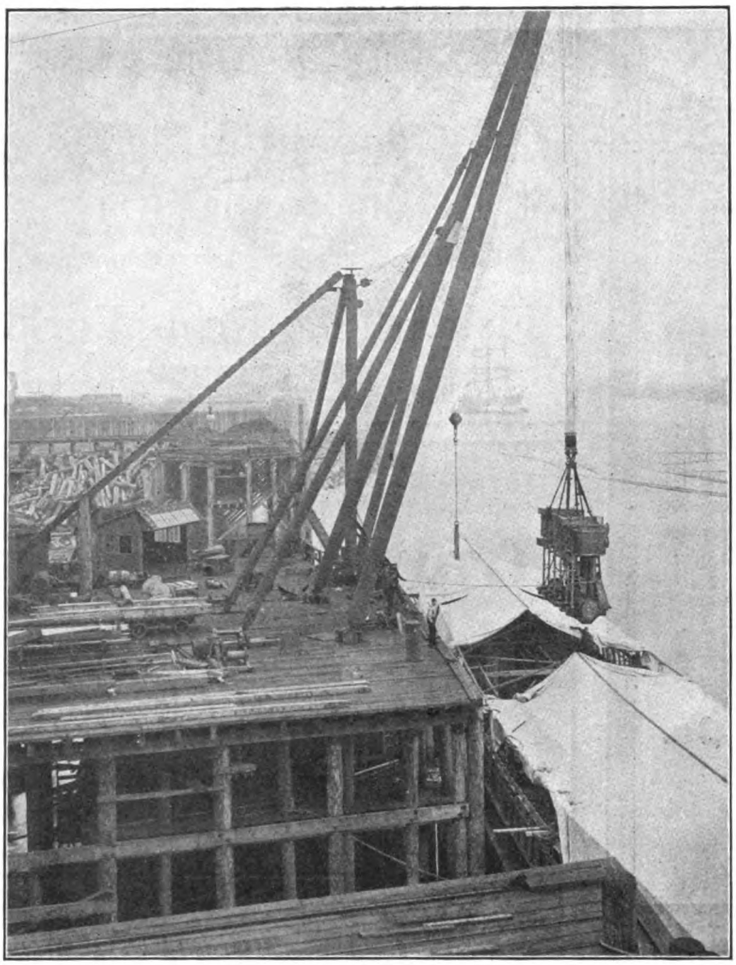
REILLY MULTICOIL



LOWERING THE MAIN ENGINE OF THE H. B. KENNEDY INTO THE STEAMER AT THE YARD OF THE WILLAMETTE IRON & STEEL WORKS, PORTLAND, ORE.
For description see MARINE REVIEW, *Dec. 17.*

of the Scotch type, 66 in. in diameter by 10 ft. long and fitted with one Adamson furnace, while that for the tug Ciscoe is of the dog house type, 48 in. wide by 7 ft. long.

The Portland Ship Building Co., South Portland, Me., is engaged in making extensive repairs to the three-masted schooner Annie B. Mitchell, owned by W. E. Crockett & Co., New York.

W. F. Downs, Bayshore, L. I., N. Y., is building an auxiliary sloop yacht for E. F. Hutton, of New York. The yacht is 63 ft. over all and is from designs by Henry J. Gielow, 50 Broadway, New York City.

The Meyer Ship Building Co., National City, Cal., is a comparatively new establishment which is making a specialty of steel shallow draught steamers of the tunnel type, fitted for the navigation of shallow bays and other similar waters of the Pacific. The company has every prospect of success with this type of construction.

During the year 1908 there was turned out at the yard of E. James Tull, Pocomoke City, Md., the fishing steamer Peter C. Struven, schooner Sada, sloop Angler and yacht Comrade, aggregating 490 tons and of a total value of $27,000.

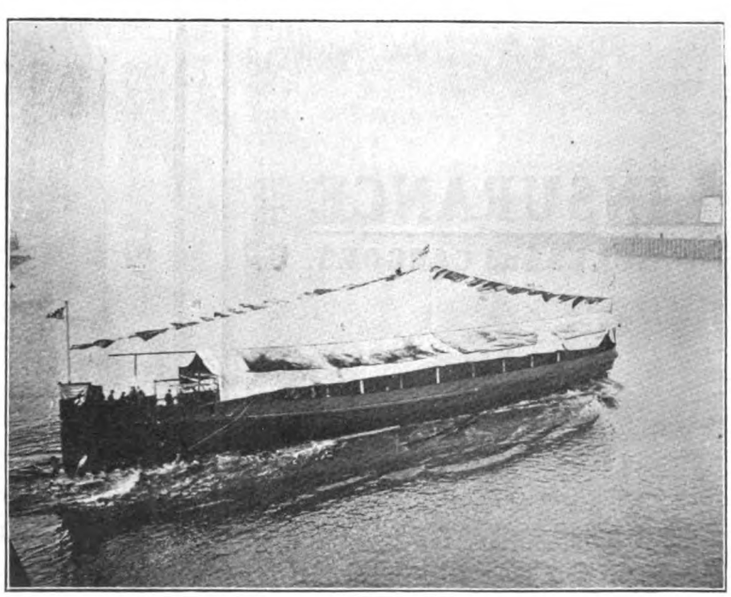
Crawford & Reid, Tacoma, Wash., and E. W. Heath, of the same city, have each been awarded a contract by the Tacoma Tug & Barge Co. for the construction of duplicate barges. The craft are to be 83 ft. long, 30 ft. beam and 7 ft. deep.

The Kelly-Spear Co., Bath, Me., expects to begin work soon on a schooner for stock in order to give employment to its workmen. A fine tug is at present under construction for the Commercial Towboat Co., of Boston, the machinery for which is being built by the Bath Iron Works, Bath, Me.

The Clifton Motor Works, Cincinnati, O., is busily engaged in getting out its line of marine gas and gasoline engines for next spring's business, having under way about 2,000 H. P. in the aggregate, of various sizes, including 14, 21, 28, 45 and 60 H. P. sizes.

Charles P. Willard & Co., Winthrop Harbor, Ill., aside from ocean-going work, supplied the fishing tug Neptune, owned by C. Carlson, of Racine, Wis., with a boiler of the submerged type, 54 by 72 in., and a high pressure high speed engine 7 by 8 in.

Brown's Transportation line, Syracuse, N. Y., is contemplating the construction of a twin-screw passenger steamer in its yard at Syracuse. The vesel, if built, will be 130 ft. long and 21 ft. beam.



THE STEAMER H. B. KENNEDY AFTER LAUNCHING.
For description see MARINE REVIEW, *Dec. 17.*

AMERICAN WIRE ROPE

is made under the most exacting requirements for strength, flexibility and durability. No other commercial form of metal is subjected to such a combination of destructive influences—heavy and sharp strains, bending, abrasion and corrosion—and yet is trusted with such a burden of human life as well as goods.

Its integrity begins at our mines, continuing through our blast furnaces, where the different specially selected ores are amalgamated. Is highly accentuated in our melting processes where the character of the steel is established. Through our rolling and wire drawing mills its individuality is finally set, when it enters into the finished wire rope and goes to our department of tests, there to receive the rigid inspection of skilled examiners to be sure that the work is perfect.

Each of these stages represents a distinct science developed by masters, and upon the skill of these masters depends the worth of the finished rope.

Facilities and organization are therefore of prime importance; and in the manufacture of American wire rope we offer the product of the greatest mines, steel producing plants and wire mills in the world, all under one ownership and control.

Thus is established and maintained the highest standard of excellence, and the user of American wire rope is assured of the best that human ingenuity can produce.

Sold direct or through our distributers. Large stocks carried at convenient points all over the country, ready for quick delivery in either short or long lengths, on reels or in coils.

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NOTICE.

At a regular meeting of the common council held on the 19th day of January, 1909, the following resolution was offered on motion of Alderman Robinson, seconded by Alderman Dillingham, and the same was adopted:

Resolved, That at a meeting of this council to be held on the 2nd day of March, 1909, sealed proposals will be received at such time to lease the privilege of operating subdivisions A and B of the western ferry district in the city of Ogdensburg, the said lease or license to begin on the first Monday of April, 1909, and to terminate on the first Monday of April, 1914. All proposals so made for the purpose above set forth shall include the operation of a day, night and Sunday ferry. Said proposals shall contain specifications of the boat or boats that will be furnished, and, if said boat or boats are now in service, there shall accompany the proposals a certified copy of the Certificate of Inspection last issued to such boats by the steamboat inspectors of the United States or Canada, as the case may be. Said proposals must contain specifications of the proposed terminal buildings to be provided and the location thereof. Also proposals shall be made exclusive of such terminals in case the city of Ogdensburg decide to provide such terminals. Proposals must state the hours at which the boat or boats shall arrive at and depart from the city of Ogdensburg and the rates that are proposed to be charged for transportation of passengers and property, including live stock, automobiles and other vehicles.

Provided that the boat with which the day ferry shall be operated shall be an A-1 in material and construction, ice-breaking steamer capable of landing at all times at the specified landing place in the city of Ogdensburg; said steamer to be of sufficient capacity to carry comfortably not less than three hundred and fifty (350) passengers, to have commodious cabins for men and women and so constructed that loaded teams may be driven on and off, double end type of construction preferred, and provided further that the boat for the night ferry shall be of sufficient capacity to carry all passengers that may desire to cross.

Provided further that the rates of ferriage of passengers and property shall not exceed those named in Section 4, Chapter 8 of the ordinances of the city of Ogdensburg, and that the terminal or landing place of said ferry shall be located at some point between the Oswegatchie river and the west line of Franklin street. The common council reserves the right to reject any or all proposals that may be submitted.

I hereby certify that the foregoing is a true copy of the resolution passed by the common council.

D. J. CRICHTON JR.,
City Clerk.

Ogdensburg, N. Y.

U. S. Engineer Office, Milwaukee, Wis., January 14, 1909. Sealed proposals for building reinforced concrete caissons and pile pier, removing old pier and dredging at Milwaukee Harbor, Wis., will be received here until 2 P. M., February 12, 1909, and then publicly opened. Information on application. W. V. Judson, Major, Engrs.

U. S. Engineer Office, 57 Park St., Grand Rapids, Mich., January 18, 1909. Sealed proposals for repair of South Pier at Frankfort, Mich., will be received here until 3 P. M., February 16, 1909, and then publicly opened. Information on application. M. B. Adams, Col., Engrs.

FREIGHT AND PASSENGER steamer for sale, 500 gross tons. Allow 600 excursionists. Will sleep 75 night passengers. Address Box 123, the MARINE REVIEW, Cleveland, O.

LUMBER STEAMER FOR SALE or charter. I have an A-1 light draft steamer to charter. She will carry about 900,000 ft. of dry lumber on 12 ft. of water, or 1,100 tons of coal. $20.00 a day net for the season. Address 2120 East 14th St., Cleveland, O.

STEAMER "LAKE SIDE" FOR sale. Engine 4 and aft compound 20-42-24 inch stroke, elec. light and search light, length 158 ft. overall, beam 28 feet, draught 8 ft. 6 in., allowed 658 passengers. Address C. A. Neilsen, Sandusky, O.

McMYLER DERRICK FOR SALE. 3 tons capacity, 14 ft. gage. Located at Cleveland. Address Box 50, MARINE REVIEW, Cleveland, O.

FOR SALE. BOAT YARD, MARINE railway. Fully equipped, near New York. Good opportuuity for boat builder or manufacturer. Railroad siding. Address "Opportunity," care the MARINE REVIEW, New York City.

FREIGHT STEAMER FOR SALE at a great sacrifice, for good and substantial reasons. Carries 425,000 ft. hardwood lumber. Recently rebuilt and as good as new. Address "Owner," Flat 5, 22 Bellevue Place, Chicago, Ill.

TUGS FOR SALE. STEEL TUG, now building, 105 ft. long overall, 21 ft. beam, 12 ft. 3 in. depth of hold. Engine 15 x 30 x 22. Scotch boiler, 150 lbs. steam. Coal capacity 80 tons. Also a tug 67 ft. long, of oak. 16½ ft. beam. 7½ ft. depth of hold. Single engine, 14 x 16. Boiler 6½ ft. x 12 ft. for 130 lbs. steam pressure. Fresh water tanks forward and aft. Independent pumps. Keel Condenser. Also two small tugs, not new. Address McIntyre & Henderson, foot of Montgomery St., Baltimore, Md.

TUG ARTHUR JONES FOR Sale, 16 x 18, 140 pounds steam, hull recently rebuilt and all in good working order. E. M. Graves, 17 Commercial Bank Bldg., Cleveland, O.

WRITE US FOR ANY BOOK ON MEchanical Subiects. Book Department, The Penton Publishing Co., Cleveland.

PROPOSALS.—Sale of U. S. S. *Inca.*—Sealed proposals will be received at the Navy Department until noon on the 10th day of February, 1909, at which time and place they will be opened, for the purchase of the U. S. S. *Inca,* appraised value, $5,300. The vessel will be sold for cash to the person or persons or corporation or corporations offering the highest price therefor above the appraised value thereof. *Proposals must be submitted in a sealed envelope addressed to the Secretary of the Navy, Washington, D. C., endorsed "Proposals for the purchase of the U. S. S. Inca," and each proposal must be accompanied by a satisfactory certified check for not less than 10 per cent of the amount of the offer.* On application to the Navy Department forms of bids and bonds, together with the terms and conditions of sale, also a printed list giving general information concerning the vessel, will be furnished. The vessel can be examined at any time after the date hereof by applying to the commandant of the Navy Yard, Boston, Mass. It must be removed from the limits of the navy yard within such reasonable time as may be fixed by the Department. The Department reserves the right to withdraw the vessel from sale and to reject any or all bids. H. L. SATTERLEE, *Acting Secretary of the Navy.* 1-7-09

U. S. Engr. Office, Boston, Mass., Jan. 6, 1909. *To whom it may concern:* Whereas navigation is obstructed and endangered by wrecks of steamers "Germania" and "Reindeer;" canal boats "Geo. D. Cull," "John R. Myers," "North Star," "E. D. Case," "Richmond," "William Parker," "F. J. Bailey," "Governor Roosevelt," "Georgie T." and "Armenia Allore," and by hulks of eight (8) other canal boats, names unknown, in the narrows of Lake Champlain, New York and Vermont: Notice is hereby given that unless otherwise removed within thirty days, they will be removed by the United States under authority of law. Sealed proposals for their removal will be received here until 12 M., Feb. 6, 1909, and then publicly opened. Information on application. Edw. Burr, Lieut. Col., Engrs.

PASSENGER STEAMER CHEQUAMEGON. Built in 1903. Allowed 400 passengers. Triple-expansion engines. 175 lb. steam pressure. 125 ft. over all. 22 ft. beam. Electric lights. Search light. Steam steering gear. Draught, 8 ft. 10 in. Rated A1. Information and price apply to C. A. Webb, Traverse City, Michigan.

COMBINED FREIGHT AND PASsenger steamer "Japan" for sale, gross tonnage 1239; allowed 200 passengers; keel 210 ft., beam 32 ft. 6 in., depth 14 ft.; iron hull, bottom of hull wood sheathed. Laid up at Buffalo, N. Y. Also iron freight steamer "Alaska," for sale; gross tonnage 1288; equipped for handling package freight; keel 212 ft. 6 in., beam 32 ft., depth 13 ft. 9 in. Laid up at Erie, Pa. For further information and prices apply to J. C. Evans, Western Manager, The E. & W. T. Co. (Anchor Line), Buffalo, N.Y.

FOR SALE
14-24-40 x 30 Triple Expansion Engine.
22-50 x 30 F. & A. Compound Engine.
3 Steam Windlasses.
2 Steam Steerers.
Surface Condensers—200 to 3,500 sq. ft.
Steam Driven Jet Condensers.
Steam Driven Blowers.
30 K. W., 50 K. W., 75 K. W. Lighting Sets.
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